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AN ESTIMATE OF DEFICIENCIES AND FUNDING SOURCES FOR TRANSPORTATION IN NEW JERSEY

PREPARED BY:

NEW JERSEY DEPARTMENT OF TRANSPORTATION
DIVISION OF PLANNING AND RESEARCH

IN COOPERATION WITH
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

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Co-Authors:

Dick Hollinger, Division of Research and Demonstration
Gene Reilly, Division of Research and Demonstration (Coordinator)
Mark Smith, Division of Research and Demonstration

General Direction and Editing:

Al Harf, Director of Planning and Research

Data was Supplied or Analyzed by Staff of the Department:

Tony DeJohn, Division of Comprehensive Transportation Planning
Bob Kraml, Division of Comprehensive Transportation Planning
John Moore, Division of Comprehensive Transportation Planning
John Obermeier, Division of Comprehensive Transportation Planning

George Kuziw, Division of Data Base Generation
George Thomas, Division of Data Base Generation
Lou Whiteley, Division of Data Base Generation

Ken Afferton, Division of Design
Ed Dayton, Division of Design
John Pacholek, Division of Design

Ric Barros, Division of Research and Demonstration
Jack Croteau, Division of Research and Demonstration
Brian Margerum, Division of Research and Demonstration
Dave Temperley, Division of Research and Demonstration
Nick Vitillo, Division of Research and Demonstration
Dick Weed, Division of Research and Demonstration

The typed text was prepared by:

Gail Flynn

With an assist from:

Lorraine Stallings
Jayne Karney

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EXECUTIVE SUMMARY

New Jersey's transportation system is a gridwork of local, county and state roads integrated with a bus and rail network that is primarily publically maintained and operated. An analysis of the currently known and projected deficiencies on this integrated system is the subject of this report.

Highway deficiencies were estimated using the Department's Transportation Plan for the short-term new alignments, planning projections for long-term, high growth area requirements and new alignments, an FHWA model for existing system roadway deterioration and congestion requirements, department projections for bridge deterioration and the County and Municipal Study Commission Report for local deficiencies. The highway deficiencies are determined to the year 2000 and amount to over $11 billion for state maintained roads and almost $4 billion for local maintained roads, assuming that improvements are made at a rate fast enough to address newly materializing needs and eliminate the existing needs by the year 2000. If the rate of improvements is slower than this, the total dollar magnitude of deficiencies to the year 2000 will be even greater.

In addition to the state roadway deficiencies that are tabulated, it was determined that almost 150 miles of road will sustain congestion problems that cannot be addressed in the conventional manner of road widening. If conventional means were used and physical limitations to the widenings didn't exist, they would account for over $4 billion in additional capacity deficiencies.

In estimating public transit deficiencies, NJ TRANSIT considered the bus and rail rolling stock and facility requirements for the next six years, in addition to the currently known corridors and regions where public transit will be expanded or instituted. The total public transit deficiencies were estimated at about $3 billion through the year 1992.

If all transportation system deficiencies are combined through the year 1992, for local and state roads and the public transit network, they would amount to $10.5 billion. Suggestions are made as to the level of effort the Department should expend on the various categories of improvements. There is also a discussion of potential sources of funding for the highway improvements. It should also be mentioned that no attempt was made to analyze staff resource potential vis-a-vis the estimated level of deficiency. As a final note, if inflation were taken into account, the estimated cost of deficiencies would be substantially higher than $10.5 billion.

PART I. HIGHWAYS

I. SUMMARY FOR HIGHWAYS

New Jersey is one of a minority of states that does not have a long term stable funding source for its operations and capital needs. The 1984 Transportation Trust Fund added a measure of stability to capital transportation funding in the state, but only for a four year period (fiscal years 1985 through 1988). Because federal dollars have not materialized to the extent they were expected, and because project costs have escalated, state funds from the Trust Fund are being expended at a faster rate than expected and it is anticipated that by June 1987 all Trust Fund related state funds will have been committed.

This report examines the nature of the transportation deficiencies that will continue to exist after the current Trust Fund program. These are summarized in Tables 1A and 1B for the time periods from 1985 to the year 2000. If funding on the system is to be maintained at the current level, over $12 billion will be required for all road systems combined. However, if we want to eliminate the backlog of deficiencies by the year 2000, over $15 billion will be required for all road systems combined, assuming that improvements can be made quickly enough to eliminate the backlog of deficiencies which presently exist to the year 2000. Each table also provides the effects of five percent annual inflation over 1985 costs. These are shown in the lower half of each table.

Table 12 delineates how resources should be allocated among types of improvements, based on maximizing the benefits to the user, while minimizing long-term costs to the Department. In summary, a recommended percentage distribution of funding by category is as follows:

16-Mar-86

Table 1A
Funding to Keep Highway System at Current Status

Annual Funding by Time Period (in millions of 1985 dollars)

	Improvement Category	FY 85-87	FY 88-91	FY 92-95	FY 96-99
STATE HIGHWAYS	Bridges	125	205	205	205
	New Alignment	375	91	104	90
	Existing System	190	252	240	292
	Subtotal	690	548	549	587
MUNICIPAL/ COUNTY ROADS	Bridges	9	9	9	9
	Local Aid	80	110	110	110
	Local Needs in High Growth Corridors	0	80	201	221
	Subtotal	89	199	320	340
GRAND TOTAL		779	747	869	927

Annual Funding by Time Period (in millions of current year dollars)

	Improvement Category	5 % Annual Inflation 1985 + FY 85-87	FY 88-91	FY 92-95	FY 96-99
STATE HIGHWAYS	Bridges	125	249	303	368
	New Alignment	375	111	154	162
	Existing System	190	306	354	524
	Subtotal	690	666	811	1054
MUNICIPAL/ COUNTY ROADS	Bridges	9	11	13	16
	Local Aid	80	134	163	198
	Local Needs in High Growth Corridors	0	97	297	327
	Subtotal	89	242	473	540
GRAND TOTAL		779	908	1283	1594

16-Mar-86 Table 1B

Funding to Eliminate the Backlog of Deficiencies by 2000

Annual Funding by Time Period (in millions of 1985 dollars)

	Improvement Category	FY 85-87	FY 88-91	FY 92-95	FY 96-99
STATE HIGHWAYS	Bridges	125	250	250	250
	New Alignment	375	91	104	90
	Existing System	190	441	431	471
	Subtotal	690	782	785	811
MUNICIPAL/ COUNTY ROADS	Bridges	9	25	25	25
	Local Aid	80	110	110	110
	Local Needs in High Growth Corridors	0	80	201	221
	Subtotal	89	215	336	356
GRAND TOTAL		779	997	1121	1167

Annual Funding by Time Period (in millions of current year dollars)

	Improvement Category	5 % Annual Inflation 1985 + FY 85-87	FY 88-91	FY 92-95	FY 96-99
STATE HIGHWAYS	Bridges	125	304	369	449
	New Alignment	375	111	154	162
	Existing System	190	536	637	845
	Subtotal	690	951	1160	1456
MUNICIPAL/ COUNTY ROADS	Bridges	9	30	37	45
	Local Aid	80	134	163	198
	Local Needs in High Growth Corridors	0	97	297	397
	Subtotal	89	261	496	639
GRAND TOTAL		779	1212	1656	2095

	Beyond 1987
Bridge	19%
New Alignment	18
Condition	6
Capacity	45
Safety	4
Miscellaneous	8

In addition to the funding deficiencies shown in Table 1, there are over $4 billion in capacity deficiencies that cannot be accomplished on the existing alignments because of apparent physical constraints outside the right-of-way. Although needed improvements occur over time (such as bridges and condition improvements), a substantial portion of the deficiencies shown are backlogs that could not be accomplished with the available funds.

Concentrating on the period 1988 to 1991 and assuming a level of state bridge improvements of $125 million/year in that period, it is estimated that $905 million would be required on an annual basis to keep pace with the deficiencies on the local, county and state highway systems, reduce the backlog of deficiencies on the existing state system and construct new alignment needs. This report, however, does not analyze the professional resources or organizational requirements that will be needed to address these deficiencies.

II. RECENT HISTORY

A. Trust Fund

In January 1984, Governor Kean proposed to the legislature a stable source of funds to enable the New Jersey Department of Transportation and NJ TRANSIT to address long-standing, unmet transportation needs that had developed in New Jersey. Prior to this proposal, state funding for transportation was appropriated from general revenues, with an occasional voter approved bond program thrown in. This meant that the amount of funding, which varied from year to year, was not assured. With minor modifications, the Governor's proposal was enacted into law in 1984. The end result, the New Jersey Transportation Trust Fund, was the largest single funding program ever applied to transportation in the state. $2.2 billion was designated for highways -- addressing needs on the county and municipal roads, the rehabilitation of bridges, the roadways requiring resurfacing, the completion of the interstate system and scores of congestion and safety problems throughout the state. The remaining $1.1 billion was designated for mass transit to enable NJ TRANSIT to continue the wholesale rehabilitation of the state's deteriorated bus and rail systems.

B. Accomplishments of Trust Fund

Through December 1985, over $900 million of the $2.2 billion of the Trust Fund has been put under contract. By July 1987, almost $2 billion of the Fund will be programmed or under contract. This is a committment of 90 percent of the funds that were expected to take the highway capital program into the middle of 1988. The balance of funds is as follows:

Category	Committed Thru 12/85	To Be Committed Between 12/85 & 7/87
Bridge		
New Alignments	$904 million	$1060 million
Existing Systems		

Inflation has accounted for the committment of all of the available state funds -- leaving just a small amount of the federal funds unmatched and uncommitted.

C. Trust Fund Program Status

Expectations were high at the outset of the Trust Fund Program toward overcoming some of the most troubling problems that faced the highway transportation system in New Jersey. At that time, the federal government made additional gasoline tax funds available to the states, enabling their capital programs to accelerate. Concurrently, New Jersey and the New York metropolitan area were in an upsurge of residential and commercial office development. The combination of the three factors strained the construction industry's ability to satisfy the demand. The law of supply and demand pervaded and the construction cost for the highway program escalated.

At the same time as this escalation eroded the purchasing power of the available resources, the resources themselves fell short of expectations because of unforeseen cutbacks in federal funds. Collectively, these circumstances necessitated a higher rate of state expenditures for projects and a smaller overall program despite the fact that the overall expenditures were no less than originally expected. As a result, some of the projects included in the program will not be achieved by the Trust Fund.

D. Status of Highway System

Except for two "lulls" in the growth of traffic (caused by the gasoline shortages of 1973-4 and 1979), the demands on the highway system have been advancing steadily. Figure 1 shows a brief history of the climb in the vehicle miles travelled and registered vehicles in the state. The increase in the number of households in the state and in the floor space for commercial offices are the suspected reasons for this growth. Both of these activities continue to increase (at extraordinary rates in some highway corridors), which will only add to the condition, safety and capacity needs on the road system.

This report addresses all the categories of improvements that will be required on the highway system to the year 2000. Although the current Trust Fund Program is making substantial progress in relieving problems that had developed, there are many that are beyond the funding ability of the four year program. Moreover, as traffic growth continues and the existing physical plant continues to age, new problems materialize.

A highway system's needs can be classified into four broad areas:

Condition - The surface and subsurface ability of roadways and bridges to carry traffic loads.

Capacity - The ability to satisfy the demands of increased traffic and development into new regions.

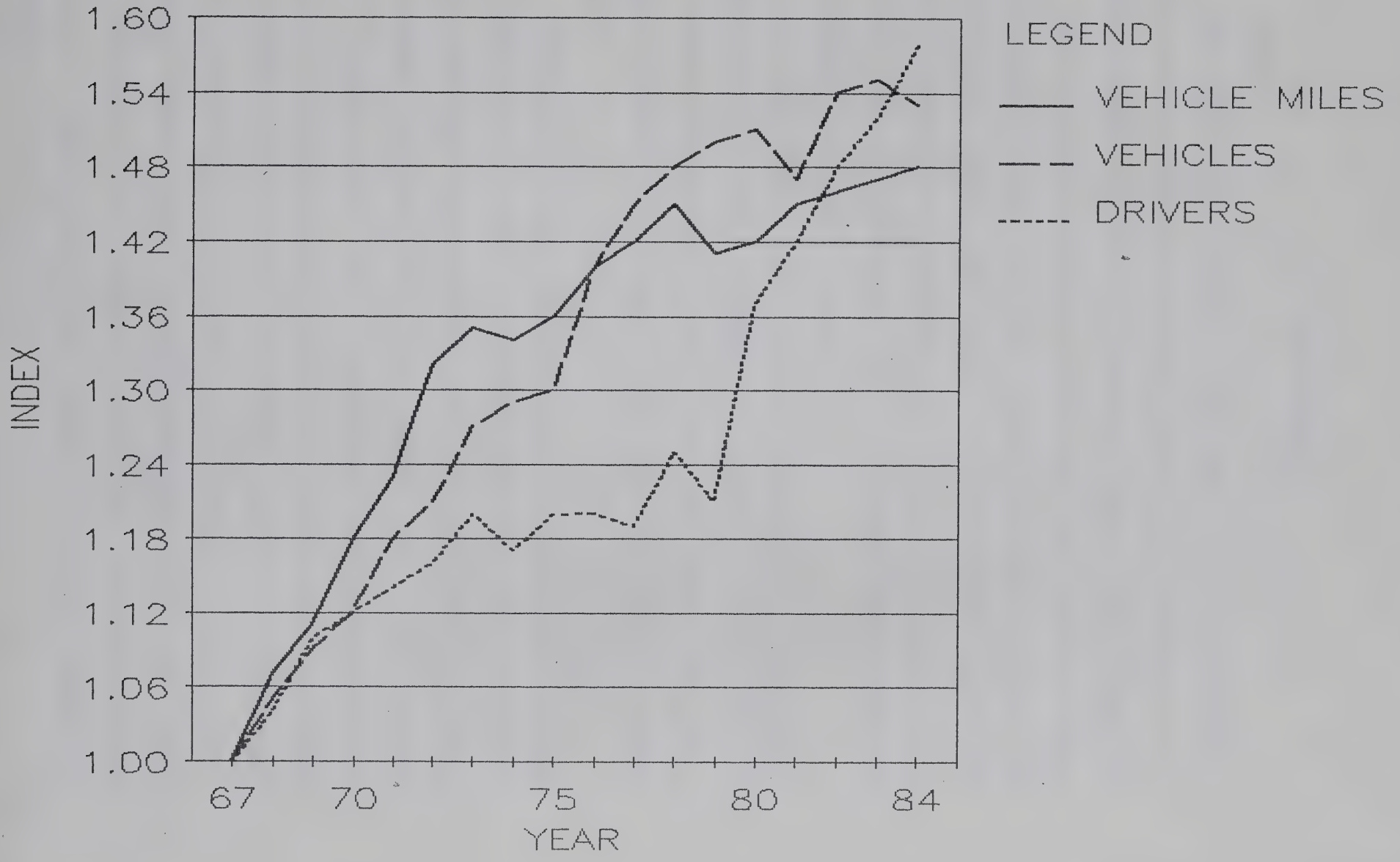
Safety - The physical and geometric features of the road system that both provide room for error and "forgiveness."

Miscellaneous - The features of a road that support the foregoing, e.g, signing, drainage, fencing, etc.

These categories are expressed in terms of the state's bridge rehabilitation, new alignment needs, existing system requirements (excluding bridges which are separately accounted for), local area needs in high growth areas and the local aid program (for the County and Municipal systems).

Figure 1

TRAVEL TRENDS IN NEW JERSEY



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III. DEFICIENCIES

A. Bridges

New Jersey, like the rest of the United States, is experiencing a growing bridge deterioration problem. As of 1985, 13 percent of all state-owned highway bridges are considered to be in poor condition (a sufficiency rating of less than 50). Railroad overhead bridges are in even worse shape. Of these bridges, approximately 55 percent are in poor condition. If spending is held at the current level of available state and federal funds ($134 million annually), the number of bridges in the poor category will continue to grow as more bridges deteriorate than can be rehabilitated. Table 2 projects the effects on the state highway system of spending at this rate.

Using cost estimates from the New Jersey Department of Transportation's Bridge Survey, the cost just to maintain the status quo (percent of bridges in poor condition will remain the same over the period) would be $214 million annually; to eliminate the backlog by the year 2000 would require $275 million annually.

The New Jersey Bridge Rehabilitation and Improvement Act of 1983 (a total package of $335 million including a $135 million bond, $198 million federal and $2 million local and rail) made a start on arresting some of the bridge deterioration problems facing New Jersey. However, this bond issue provided a level of funding sufficient only to relieve the most serious prevailing bridge problems. A backlog of bridges in poor condition still remains and more bridges fall into this category each year. The deferred maintenance on these bridges leads to increased costs in the future. As an example, the average cost to rehabilitate a bridge from the fair category (sufficiency rating between 50 and 80) to good (above 80) is approximately $350,000 per bridge while the cost to rehabilitate a bridge from the poor category to good is approximately $3,600,000.

TABLE 2

NUMBER OF BRIDGES IN EACH CONDITION CATEGORY BY FUNDING LEVEL

(State Maintained Highway Bridges)*

	1985			1988			1991			1999		
Funding Level	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor
Existing	1285	836	427	1127	869	552	941	902	705	445	990	1113
Status Quo	--	--	--	1285	836	427	1285	836	427	1285	836	427
Eliminate Backlog	--	--	--	1171	1031	346	1057	1226	265	753	1746	49

*Includes state-owned highway bridges, highway bridges over New Jersey Transit-owned railroad and highway bridges over other railroads.

(See Appendix A for assumptions used for projections.)

New design and construction techniques are now being applied to the reconstruction of bridges that are expected to increase their useful life. These techniques should also serve to mitigate the rate of deterioration. However, no accurate estimate of their effect can be made at this time.

It can be seen from the foregoing that the bridge rehabilitation backlog in New Jersey is significant and is increasing annually. Present rates of funding will serve only to lower the rate of increase of bridges in poor condition. To halt this decline, increased levels of funding are necessary. Bridge rehabilitation deficiencies should represent a significant part of any future transportation funding effort.

B. New Alignments

The 1984 Transportation Plan (Short Range Element) identified several new highway links that must be added in the near future, either closing gaps of completed alignments, responding to the demands of development in poorly accessible regions or adding capacity in corridors where existing roads are incapable of doing so.

A large part of the projected cost of the new alignments is for completion of the Interstate system, particularly I-287. Completion of the interstate system (by the early 1990's) does not signal the end of highway or new alignment needs, however, since the process of development is not expected to abate in New Jersey. The fact that New Jersey has the highest population density, highest vehicular volume per mile of road and the largest proportion of urban area to total area of any state in the country is misleading. There are vast regions in the state that are only now experiencing intense development interest. With this process expected to continue into the 21st century, the need for new alignments will either follow -- or perhaps lead the way in some cases, in an attempt to shape future development patterns. This can be seen in Table 3, where new alignment needs over time are summarized.

TABLE 3

NEW ALIGNMENT DEFICIENCIES
(in million of dollars)

System	'85-'87	'88-'91	'92-'95	'96-'99
Interstate	$600	$11	--	--
Non-Interstate	490	280	330	360
Meadowlands	--	20	30	--
Hudson River Waterfront	10	65	60	--

A more precise listing of these needs, as envisioned at the time the 1984 Transportation Plan was drafted, may be found in Appendix B. This may not be an exhaustive list, in as much as the needs shown encompass only bypass needs and growth areas that are already evident. The next 15 years may give rise to still other growth area needs.

C. Existing System

1. HPMS Developed Deficiencies

Deficiencies for the existing state highway network can be classified as capacity deficiencies, pavement condition deficiencies, safety deficiencies and miscellaneous minor improvements. A computer model developed by the Federal Highway Administration (FHWA) entitled Highway Performance Monitoring System (HPMS) has been utilized to project deficiencies into the future. See Appendix C for a brief discussion of the HPMS model and associated modifications. Table 4 lists the total deficiencies (in millions of dollars) for each classification in the time period for which the deficiency exists. These deficiencies are based on funding at the full amount needed to improve the deficiencies which minimize the total need. At lower levels of funding, additional high-cost reconstructions would be necessary in place of lower cost resurfacings. The 1985-1987 figures are shown as a point of reference for the existing Trust Fund even though those funds are committed. The following periods are based on HPMS projections of deficiencies modified to include costs for bypasses, bridge widenings and interchange construction where HPMS identified a capacity improvement. These additional costs were developed by Planning staff based on the Transportation Plan and judgement. In addition, there is a 10 percent cost for Preliminary Engineering (PE) and a miscellaneous category of 15 percent for non-HPMS type safety improvements, such as lighting, barriers and drainage improvements.

TABLE 4

DEFICIENCIES BY TYPE AND TIME PERIOD
(in millions of 1985 dollars)

	1985-1987	1988-1991	1992-1995	1996-1999	TOTAL
Capacity	2449	503	593	733	4278
Condition	67	153	184	109	513
Safety	115	126	125	44	410
Miscellaneous	395	117	135	133	780
Total	3026	899	1037	1019	5981
Cumulative Total	3026	3925	4962	5981	

As can be seen in Table 4, a much larger deficiency exists for capacity improvements in the first time period than in later ones. This is indicative of a large amount of capacity deficiencies existing before 1985 on account of inadequate funding to eliminate congestion in the past. Figure 2 is a graphic presentation of the deficiencies identified in each period. As can be seen, over $2 billion in capacity needs existed prior to 1985 but were not satisfied by previous funding levels. Increasing volumes (with time) call for ever-increasing capacity deficiencies while other types of need remain stable or even decrease over time. Figure 3 is a graphic of the cumulative deficiencies over the four time periods. It should be noted that capacity deficiencies are predicated upon assumptions about traffic growth. Traffic growth rates, which accounted for planned highways on new alignment that will divert traffic from selected links, were developed by staff for each highway link.

The needs for interchange construction, bridge widenings (for widened roadways) and new bypasses around small towns (where the road is widened on either side) are not included in the basic HPMS

Figure 2
SYSTEM DEFICIENCIES BY TYPE
IN MILLIONS OF 1985 DOLLARS

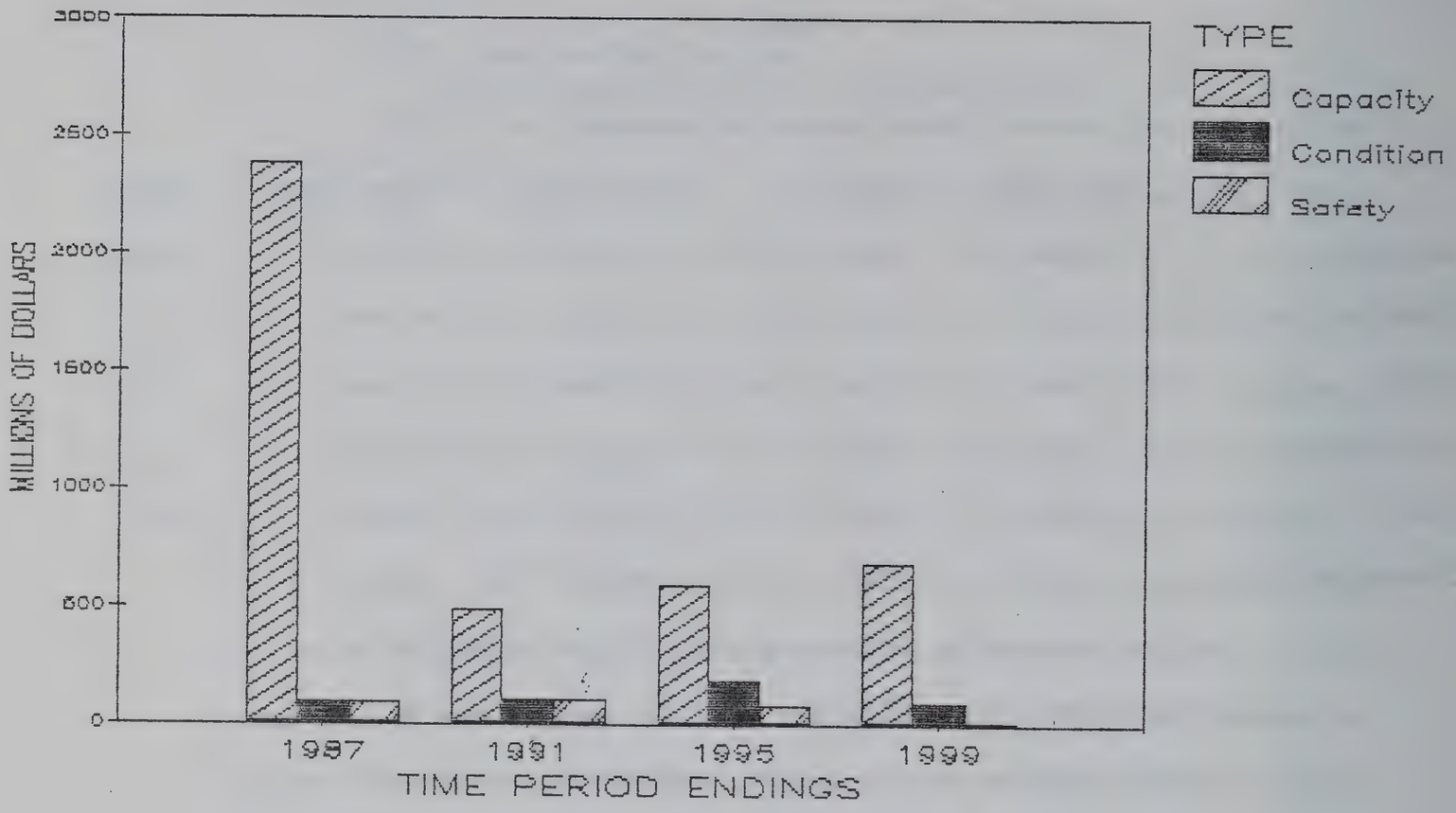
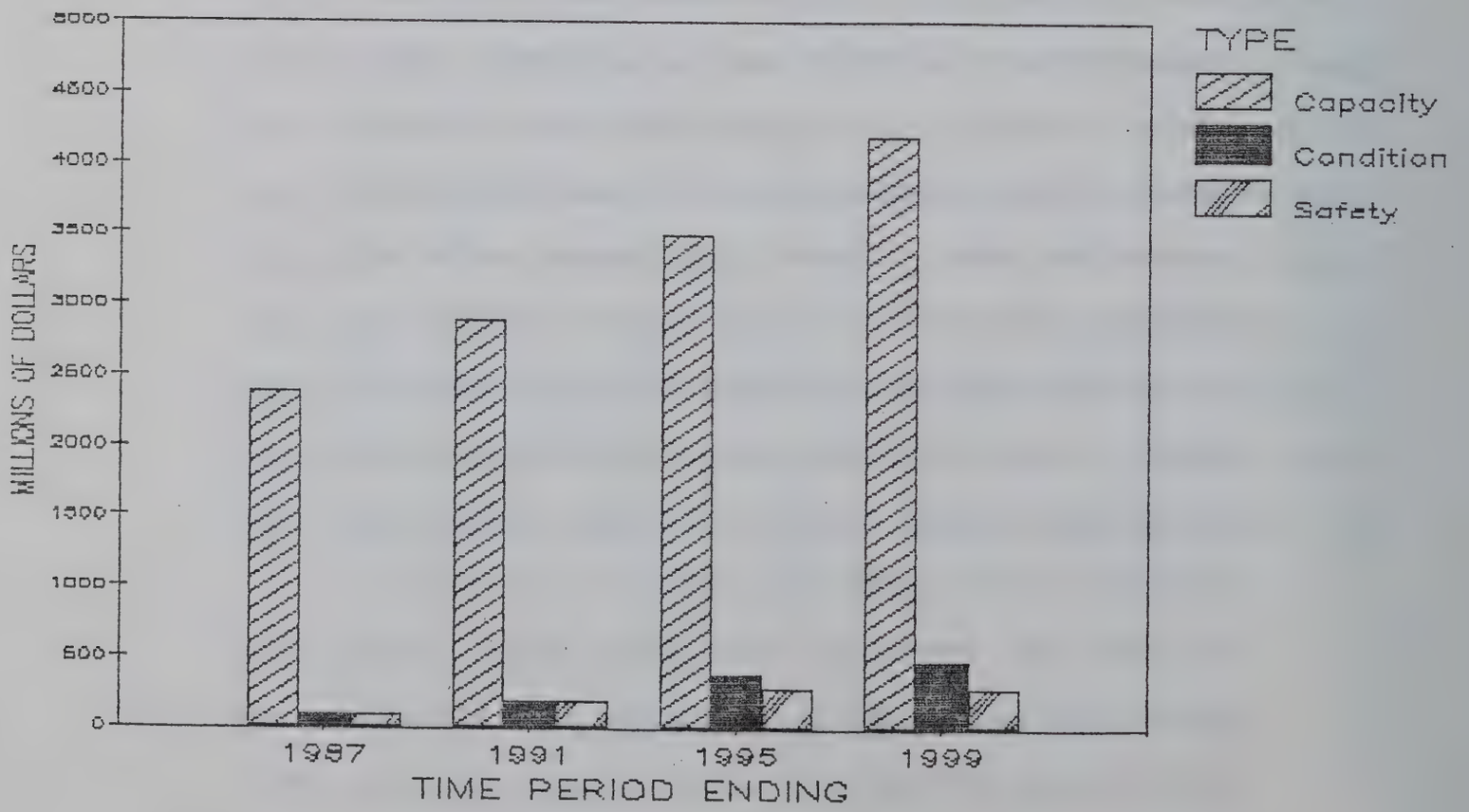


Figure 3
CUMULATIVE DEFICIENCIES BY TYPE
IN MILLIONS OF 1985 DOLLARS



program. A review of all sections of roads, requiring widening, was made to include an estimate of the above types of deficiencies for the period 1985-1999 in addition to the HPMS generated costs. The needs thus developed are $220 million for bypasses and $1.6 billion for bridge widenings and interchange construction. This totals $1.82 billion which is prorated on the basis of the HPMS generated deficiencies.

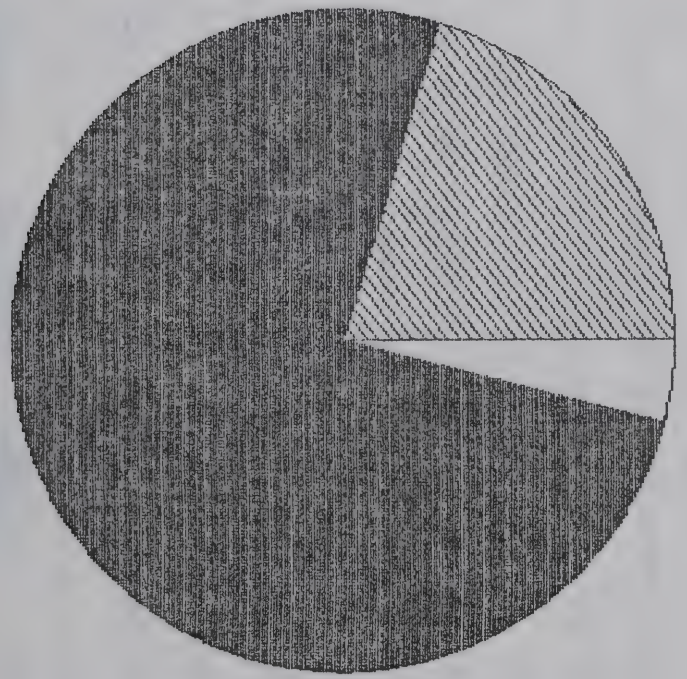
Figures 4 and 5 show the distribution of deficiencies by interstates/freeways and other state highways. Figure 4 shows miles of road by type of deficiency and Figure 5 shows the cost of improvements by type of deficiency. Figure 4 shows no miles for the miscellaneous type of deficiency since that type is not readily defined on a per mile basis. An important point to note is the much greater need for safety improvements for highways other than interstates/freeways. Obviously, the higher design standards for interstates/freeways is the most likely reason for this. It is also of interest to note the difference in the miles of condition/miles of capacity deficiencies for both types of roads. For interstates/freeways, miles of condition needs are four times greater than capacity, while for other roads, miles of condition needs are similar to capacity needs. As can be seen from Figure 5, the majority of condition, safety and miscellaneous deficiencies occur on the other state highways.

2. Capacity Deficiencies Where Widening is Not Feasible

Finally, it is important to understand that the capacity needs identified by the HPMS program have been constrained by the "ability" to widen. HPMS does not identify a widening need if

Figure 4

DEFICIENCIES BY CAPACITY, CONDITION AND SAFETY
(FOR 1985 THRU 1999 IN MILES)

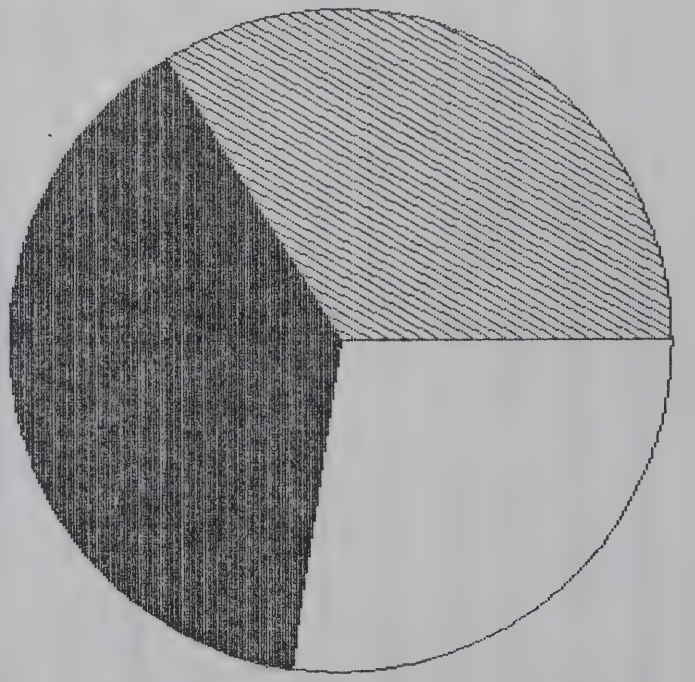


INTERSTATES AND FREEWAYS

CAPACITY 86 20.3%

CONDITION 321 75.7%

SAFETY 17 4%



OTHER STATE HIGHWAYS

CAPACITY 624 33.8%

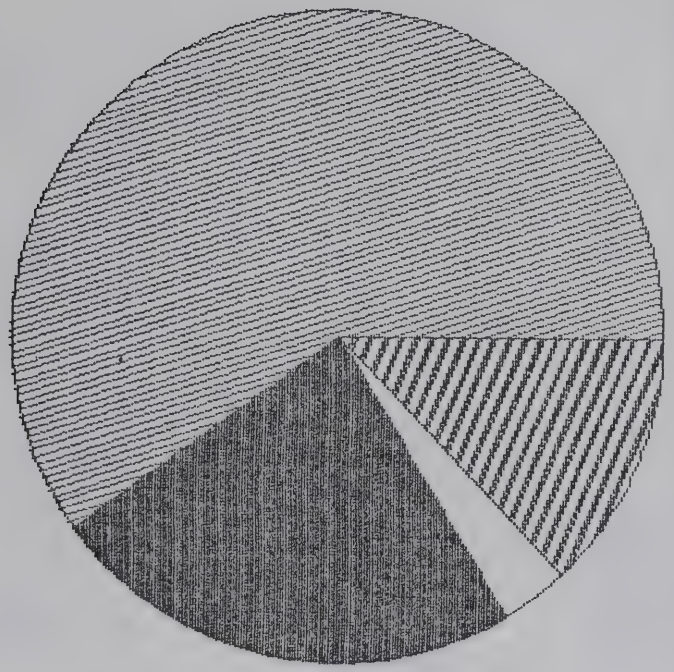
CONDITION 716 38.8%

SAFETY 505 27.4%

Figure 5

DEFICIENCIES BY CAPACITY, CONDITION AND SAFETY

(FOR 1985 THRU 1999 IN MILLIONS OF 1985 DOLLARS)



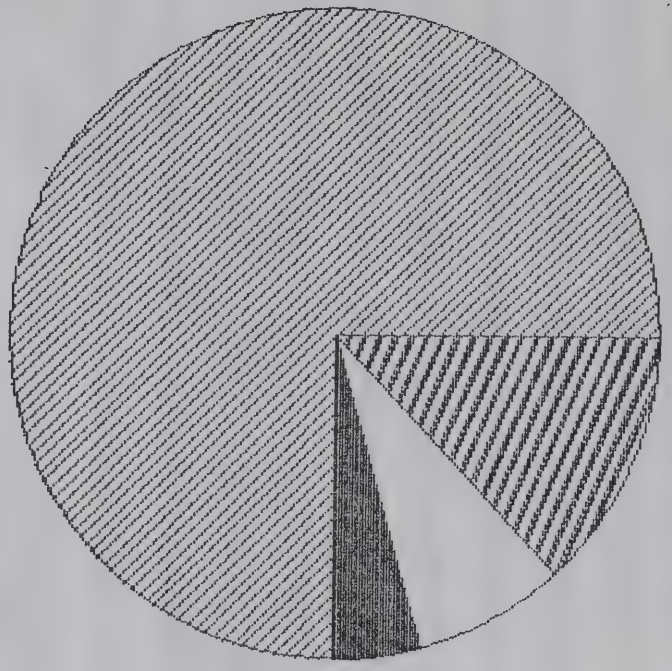
INTERSTATE AND FREEWAY

CAPACITY 700 60.1%

CONDITION 275 23.8%

SAFETY 39 3.4%

MISC. 150 12.9%



OTHER STATE HIGHWAYS

CAPACITY 3585 75%

CONDITION 211 4.4%

SAFETY 362 7.6%

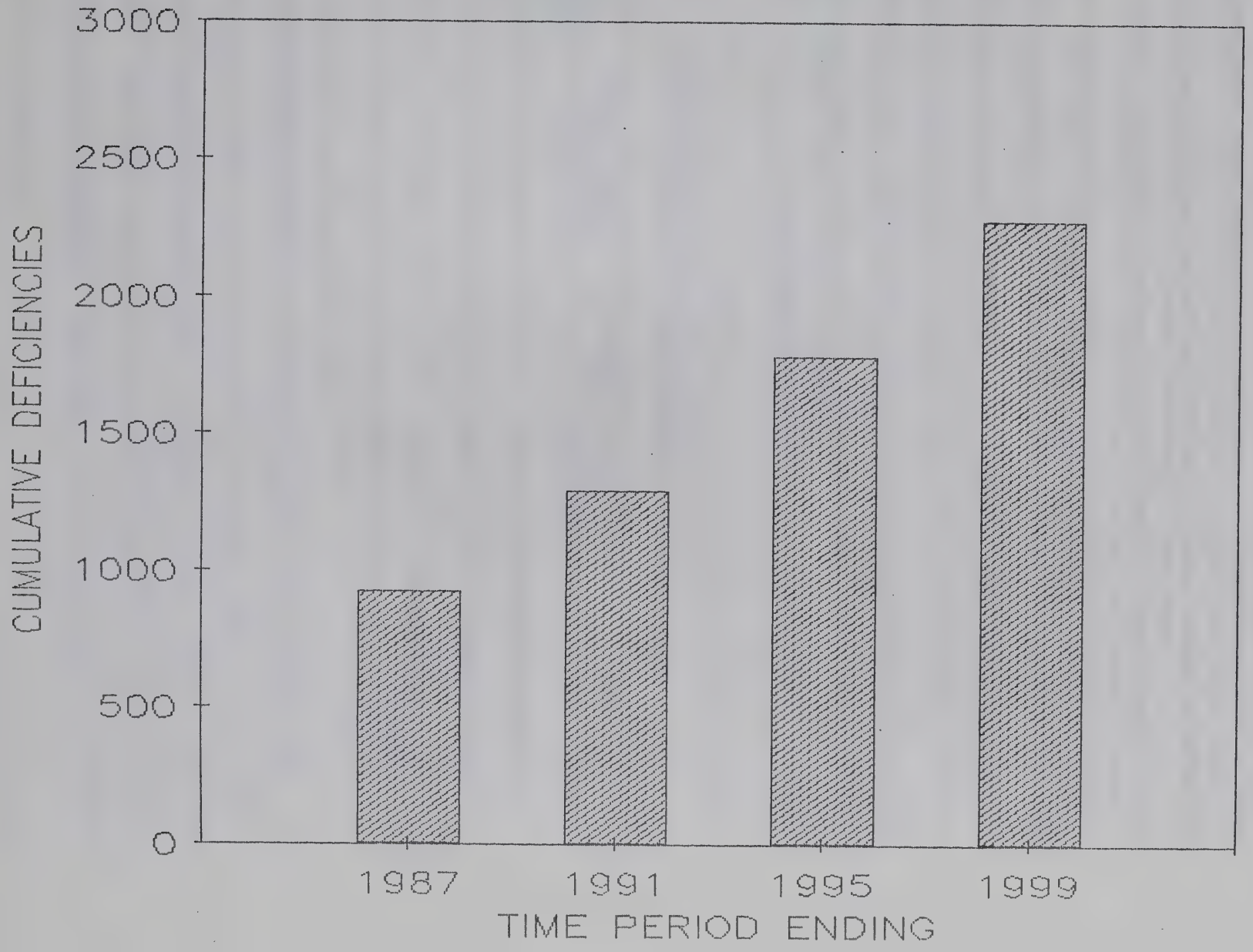
MISC. 620 13%

physical constraints preclude widening even though the road is congested. Figure 6 shows the level of capacity need that cannot be satisfied due to physical limitations. Although this "undo-able" need cannot be satisfied through traditional widenings, capacity problems exist and other non-traditional improvements should be considered.

The HPMS generated value for the costs of traditional improvements for these "un-doables" is $2.3 billion of 1985 dollars. This cost does not include any of the non-HPMS needs or PE costs. Based on the ratio of HPMS needs to total, including the other costs, the funds which would have been spent for traditional improvement would double to approximately $4.6 billion of 1985 dollars.

The reason for presenting the above information is to provide the decision makers with some idea of how much would have been spent to alleviate those congestion problems by widening the roads. It would be appropriate to consider a similar level of expenditure if non-traditional methods could be used to solve the problems.

Figure 6
CAPACITY DEFICIENCIES WHERE WIDENING IS NOT FEASIBLE
IN MILLIONS OF 1985 DOLLARS



D. Local Aid

The County and Local Government Study Commission of the New Jersey Legislature undertook in 1984 an assessment of local infrastructure needs. As part of this assessment, a questionnaire concerning local transportation infrastructure needs was sent to all the counties and municipalities within the state of New Jersey. Of the 21 counties surveyed, 19 responded. Of the 567 municipalities, 108 responded. From these returns, an estimate of capital needs that were not met by local or county government was developed for county bridges, county roads and municipal roads and streets. Estimated annual unmet needs for county roads was $15 million per year; for county bridges, $39 million per year; and for municipal roads and streets, $56 million per year - a total of $110 million per year. These estimates are for transportation needs that cannot be met by conventional sources of local funding (see Table 5).

TABLE 5

LOCAL FUNDING VS. LOCAL DEFICIENCIES
(IN MILLIONS OF DOLLARS)

	"Minimum" Capital Funding Needed Each Year	Average Annual Local Capital Expenditures	Annual Local Unmet Needs
County Road System	40	25	15
County Bridges	49	10	39
Municipal Road and Streets	105	49	56
Total	194	84	110

Estimates were also made on the basis of the survey returns for number of county roads, county bridges and municipal streets in poor or very poor condition. Results showed 19 percent of municipal streets and roads to be in poor or very poor condition, while nine percent of county roads on the federal aid highway system and 13 percent of county roads off the system were in poor or

very poor condition. The survey results also showed over 25 percent of county bridges to be in poor or very poor condition.

The report issued by the County and Municipal Government Study Commission as a result of this survey went on to make four major recommendations in the area of local transportation needs. These were:

1. It is essential that New Jersey devise a funding mechanism to assure that state, county and municipal governments can match available federal dollars.
2. That the state's proposed transportation funding plan (Transportation Trust Fund) be enacted into law.
3. That the proposed FAUS swap component of the state's transportation funding proposal be enacted into law.
4. That an additional local street and road component be enacted in the Transportation Trust Fund Proposal to replace the non-FAUS local aid component (state aid) of the 1979 Transportation Bond Act.

All of these recommendations have been implemented. Through various sources, Trust Fund I has channeled approximately $80 million per year to meet local needs. Most of this money has gone to reconstruction or resurfacing of the local road system, however, a significant amount has also gone into bridge rehabilitation. As much as this money has helped to reduce the local transportation need, it must be remembered that the estimated $110 million in local unmet needs is an ongoing annual figure.

Aside from these present identified local transportation needs, there is also a new component of local need to come on line. This need relates to local and county road capacity increases needed in various high growth corridors around the state. These local transportation needs are separate from the ongoing deficiencies described previously. These needs are more fully reviewed in the next section of this report.

E. Local Support for High Growth Areas

Growth of traffic is inevitable over the entire road system. The differences between the rates of growth between regions are vast, and dependent on numerous factors -- primarily the availability and desirability of land for large-scale development. The role of the Department is to support development, when said development is consistent with the State Development Plan.* State road and public transit system expansions address the travel need requirements of the growth areas, since there is an intricate road network, off the state system, that both feeds the developments and connects the major arterials of the road system. It is this non-state network of roads that permits the ease of access and interaction of the entire system. Without it --the investment won't yield returns and the development could stagnate.

The importance of these "local needs in support of the high growth areas" cannot be overemphasized. Several corridors and regions are experiencing extraordinary growth and local needs for local, county and state highway improvements will be high. Appendix E is a complete listing. The following table is a summary of the total $2 billion local needs estimate.

TABLE 6

HIGH GROWTH AREA LOCAL DEFICIENCIES
(TOTAL PERIOD DEFICIENCIES)

Region	Years			
	'85-'87	'88-'91	'92-'95	'96-'99
Route 1	--	$40m	$100m	$110m
Other North	--	120m	300m	330m
South	--	160m	405m	445m

*The newly created State Planning Commission is mandated to prepare a State Development Plan by mid-1987, 18 months after its creation.

The priority for action in addressing these growth areas will depend on the schedule of development and concurrent traffic growth. A suggested source of funding to complete the needed improvements is the subject of Section VI.

IV. FEDERAL FUNDING SOURCES

Federal funding presently accounts for 65 percent of transportation funding for the state. Most of this federal funding is forthcoming from the Highway Trust Fund. Essentially the Highway Trust Fund works in this way. Authorizing legislation is passed by the US Congress which sets the upper limits on liabilities the federal government can incur for federal-aid highways. Deductions from the authorized levels of funding are made for administration of the program and for transportation planning. The remaining amounts are then apportioned among the states. Apportionments do not make money available, but rather make available authority to incur obligations, a "line of credit." A state receives this authority in various funding categories, each with a defined use. Limitations, set by Congress, regulate the rate of obligation by imposing a maximum amount of total authority which can be committed during a given fiscal year.

Since FY 1986 represents the last year of a four year authorization bill, no authorized funding levels have yet been set for future transportation funds. A new authorization bill has been drafted by the administration which proposes substantially reduced funding levels (see Table 7). Along with this cut in funding, several other important changes are proposed. One change would lump Interstate, Interstate 4R and Consolidated Primary funds together in one package. These funds could then be used for work in any of the three categories. Another change would lump the Urban System and Rural Secondary Funding categories, along with funding from the Mass Transit Account of the Highway Trust Fund into an Urban Mobility Block Grant. This block grant could be used for any capital project, either Highway or Transit. Present and estimated future apportionments in the various funding categories are listed below.

TABLE 7

FEDERAL APPORTIONMENTS
(Current and Estimated)

	Current 1986 (Millions)	Estimated 1987 (Millions)
Interstate	$129.0	53.3
Interstate - 4R	35.8	38.8
Consolidated Primary	56.6	64.6
Urban Systems - Non-Attributable	1.8	28.5
Urban Systems - Attributable	28.0	
Local and Urban System	--	36.4
Rural Secondary	5.5	5.6
HPR	5.4	3.3
Planning	2.3	0.8
Bridge Replacement	97.0	59.1
Railroad/Highway Hazard Elimination	3.2	3.2
Hazard Elimination	5.0	4.4
Interstate Transfer	37.4	25.8
TOTAL	$407.0	323.8

The most likely projections for future federal funding entail a cut of between 10 to 20 percent from the current levels. These cuts in federal funding level can also be anticipated to continue in the future because of the ongoing effort to reduce the deficit. The combination of reduced federal funding and expanding needs requires that more state and other funds be made available than in past funding efforts.

V. INVESTMENT STRATEGY

Before beginning to investigate the funding alternatives, it is important to understand that the total amount of future deficiencies will change depending on the funds invested. If inadequate funds are provided for resurfacing improvement, the pavement will deteriorate to the point where reconstruction will be required at a substantially higher cost. Investments made by use of the HPMS model do stress the resurfacing types of improvements so that the total deficiencies are minimized.

A second factor can influence the level of funding to be required. That factor is the longer range objectives of the funding package. As detailed below, the objective of eliminating the backlog of deficiencies which has developed due to inadequate funding in the past will require a higher investment than an objective of simply preventing any increase in the level of deficiencies.

A. Investment Objectives

Two approaches can be considered to determine the level to fund the deficiencies developed in Section III. One rationale for establishing the required level of funding is to establish as an objective the maintenance of the status quo. In other words, this level of funding would be adequate to avert any increase in the total need, and the backlogged deficiency from the first time period would be maintained. A second approach is to meet future deficiencies and eliminate the backlog by some future date. After that date, funding would be required only to meet needs as they arise each year and the system would be in the best possible status.

However, it must be kept in mind that the New Jersey Department of Transportation cannot gear-up to a large capital program overnight. Therefore, a short term goal should be set so that in several years the Department's ability to produce can be increased to that necessary to achieve the desired results. A

long term stable funding package can provide the direction necessary for the Department to improve resources to produce the level of improvements needed.

B. Levels of Investment

Table 8 shows the level of funding required to maintain the status of the state highway system as it is today, complete new alignments which have been identified, provide needed local assistance and define local deficiencies in high growth areas. The figures are annual expenditures in 1985 dollars which, of course, will increase as a result of inflation. The results of five percent annual inflation, beginning with the 1988-1991 time period, are shown in Table 9. As can be seen in Table 9, five percent inflation can cause the dollars of need in the last time period to nearly double. Figure 7 visually depicts the increased costs due to five percent inflation. Using 1985 dollar investment, it will be necessary to invest $748 million per year in the 1988-1991 time period. Because of increased "local needs in high growth areas," this increases to about $900 million per year in subsequent time periods.

For state highways, the investments in the deficiencies in 1985 dollars are reduced from a funding level of $690 million/year to less than $600 million/year from 1988-2000. These aggregate deficiencies on the state-maintained system reflect significant increases in bridge and existing system deficiencies over time and reductions in new alignment deficiencies. While roadway design resources can be shifted from new alignment improvements to improvements on the existing system without much problem, the great increase in bridge investment will require much more effort by the Department's Structural Design unit.

To address the second objective, Table 10 shows the total investment needed to eliminate the full backlog of deficiencies by 2000 and also meet the additional deficiencies as they arise. As with the lower funding level, surface design resources at the current level are adequate to handle the future needs by

Table 8
Funding to Keep Highway System at Current Status

Annual Funding by Time Period (in millions of 1985 dollars)

	Improvement Category		FY 85-87	FY 88-91	FY 92-95	FY 96-99	Total Investment for 15 Years
STATE HIGHWAYS	Bridges	State Highway	125	205	205	205	2835
	New Alignment	Interstate	201	3	0	0	615
		Non-Interstate	154	49	37	40	966
		Hudson R. Wtrfrnt	3	16	15	0	133
		CONRAIL Relocation	10	4	0	0	46
		169/185 Shortfall	7	5	0	0	41
		Meadowland WF conn	0	5	7	0	48
		East-West Freeway	0	5	25	40	280
		Rt. 55 Extension	0	2	9	10	84
		Rt. 18 Freeway	0	1	6	0	28
		Rt. 24 Connector	0	1	5	0	24
		Total	375	91	104	90	2265
	Existing System Incld. 10% for PE	Capacity Improv.	114	157	138	223	2414
		Condition Improv.	20	34	42	20	443
		Safety Improve.	31	28	29	11	363
		Misc. (15%)	25	33	31	38	483
		Total	190	252	240	292	3702
MUNICIPAL AND COUNTY ROADS	Bridges	Non-state Hwy					
		Over NJ Transit	6	6	6	6	90
		Over Other RR	3	3	3	3	45
		Total	9	9	9	9	135
	Local Aid	County	55	54	54	54	813
		Municipal	25	56	56	56	747
		Total	80	110	110	110	1560
	Local Needs of High Growth	Route 1	0	80	201	221	2008
STATE HIGHWAYS		ANNUAL TOTAL	690	548	549	587	
		PERIOD TOTAL	2069	2191	2195	2347	8802
MUNICIPAL AND COUNTY ROADS		ANNUAL TOTAL	89	199	320	340	
		PERIOD TOTAL	267	796	1280	1360	3703
ALL ROADS		ANNUAL TOTAL	779	747	869	927	
		PERIOD TOTAL	2336	2987	3475	3707	12505

16-Mar-86

Table 9

Funding to Keep Highway System at Current Status

Annual Funding by Time Period (in millions of current year dollars)

	Improvement Category		5 % Annual Inflation 1985 + FY 85-87	FY 88-91	FY 92-95	FY 96-99
STATE HIGHWAYS	Bridges	State Highway	125	249	303	368
	New Alignment	Interstate	201	4	0	0
		Non-Interstate	154	60	55	72
		Hudson R. Wtrfrnt	3	19	22	0
		CONRAIL Relocation	10	5	0	0
		169/185 Shortfall	7	6	0	0
		Meadowland WF conn	0	6	10	0
		East-West Freeway	0	6	37	72
		Rt. 55 Extension	0	2	13	18
		Rt. 18 Freeway	0	1	9	0
		Rt. 24 Connector	0	1	7	0
		Total	375	111	154	162
	Existing System Incld. 10% for PE	Capacity Improv.	114	191	204	400
		Condition Improv.	20	41	61	36
		Safety Improve.	31	34	43	19
		Misc. (15%)	25	40	46	68
		Total	190	306	354	524
MUNICIPAL AND COUNTY ROADS	Bridges	Non-state Hwy Over NJ Transit	6	7	9	11
		Over Other RR	3	4	4	5
		Total	9	11	13	16
	Local Aid	County	55	66	80	97
		Municipal	25	68	83	101
		Total	80	134	163	198
	Local Needs of High Growth	Route 1	0	97	297	327
STATE HIGHWAYS		ANNUAL TOTAL	690	666	811	1054
		PERIOD TOTAL	2069	2663	3242	4215
MUNICIPAL AND COUNTY ROADS		ANNUAL TOTAL	89	242	473	540
		PERIOD TOTAL	267	968	1891	2161
ALL ROADS		ANNUAL TOTAL	779	908	1283	1594
		PERIOD TOTAL	2336	3631	5134	6376

Figure 7

EFFECTS OF 5% ANNUAL INFLATION
IN MILLIONS OF DOLLARS USING
1985 AS THE BASE

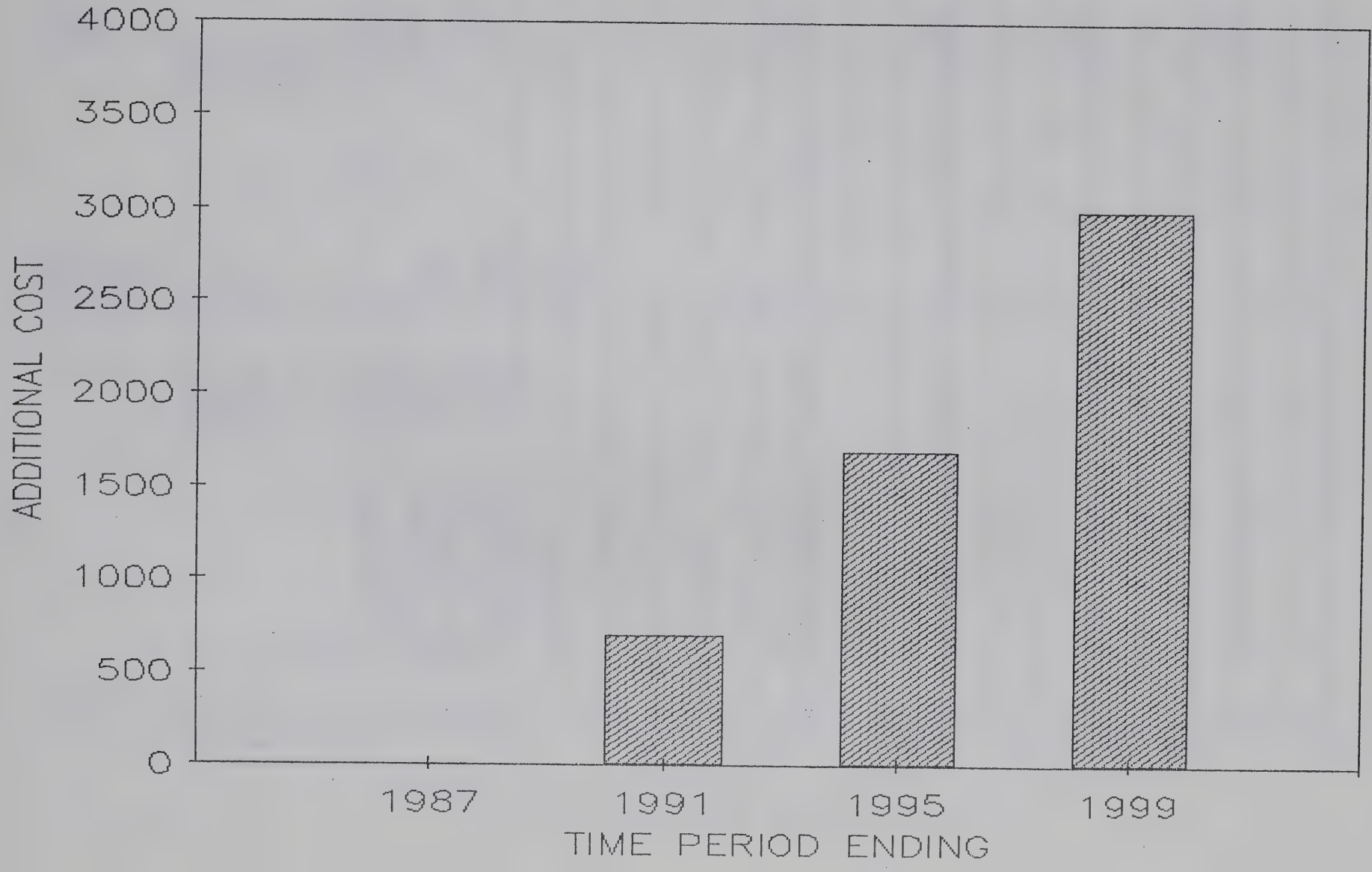


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Table 10
Funding to Eliminate the Backlog of Deficiencies

Annual Funding by Time Period (in millions of 1985 dollars)

	Improvement Category		FY 85-87	FY 88-91	FY 92-95	FY 96-99	Total Investment for 15 Years
STATE HIGHWAYS	Bridges	State Highway	125	250	250	250	3375
	New Alignment	Interstate	201	3	0	0	615
		Non-Interstate	154	49	37	40	966
		Hudson R. Wtrfrnt	3	16	15	0	133
		CONRAIL Relocation	10	4	0	0	46
		169/185 Shortfall	7	5	0	0	41
		Meadowland WF conn	0	5	7	0	48
		East-West Freeway	0	5	25	40	280
		Rt. 55 Extension	0	2	9	10	84
		Rt. 18 Freeway	0	1	6	0	28
		Rt. 24 Connector	0	1	5	0	24
				0	0	0	0
		Total	375	91	104	90	2265
	Existing System Incld. 10% for PE	Capacity Improv.	114	315	298	371	4278
		Condition Improv.	20	38	42	27	487
		Safety Improve.	31	31	35	11	401
		Misc. (15%)	25	58	56	61	775
		Total	190	441	431	471	5941
MUNICIPAL AND COUNTY ROADS	Bridges	Non-state Hwy					
		Over NJ Transit	6	19	19	19	246
		Over Other RR	3	6	6	6	81
		Total	9	25	25	25	327
	Local Aid	County	55	54	54	54	813
		Municipal	25	56	56	56	747
		Total	80	110	110	110	1560
	Local Needs of High Growth Corridors		0	80	201	221	2008
STATE HIGHWAYS		ANNUAL TOTAL	690	782	785	811	
		PERIOD TOTAL	2069	3129	3140	3242	11581
MUNICIPAL AND COUNTY ROADS		ANNUAL TOTAL	89	215	336	356	
		PERIOD TOTAL	267	860	1344	1424	3895
ALL ROADS		ANNUAL TOTAL	779	997	1121	1167	
		PERIOD TOTAL	2336	3989	4484	4666	15476

diverting efforts from the reduced new alignment deficiencies to existing system deficiencies. However, a substantially greater level of effort will be required for bridge rehabilitation. Table 11 shows the needs in current year dollars at a rate of five percent annual inflation. Figure 8 shows the effect of three investment scenarios on bridge condition. Current funding ($134 million per year) is not sufficient to maintain the status quo. This would require approximately $214 million per year, while to eliminate the backlog would require approximately $275 million per year. (All figures include Rail Overhead bridges.) The increase in bridge work which is warranted to maintain the status quo will require time to achieve and should be planned for now.

C. Optimum Investment Strategy

A desirable resource allocation for the state highway system which would maintain the current level of funding while distributing resources between new alignments and the existing system is shown in Table 12. It should be noted, however, that the level proposed for bridges ($125 million per year) as seen previously is not sufficient to maintain the status quo, and that a build up in bridge design resources should be started in order to eventually produce the effort required to maintain the status quo in this area.

16-Mar-86

Table 11
Funding to Eliminate the Backlog of Deficiencies

Annual Funding by Time Period (in millions of current year dollars)

	Improvement Category		5 % Annual Inflation 1985 + FY 85-87	FY 88-91	FY 92-95	FY 96-99
STATE HIGHWAYS	Bridges	State Highway	125	304	369	449
	New Alignment	Interstate	201	4	0	0
		Non-Interstate	154	60	55	72
		Hudson R. Wtrfrnt	3	19	22	0
		CONRAIL Relocation	10	5	0	0
		169/185 Shortfall	7	6	0	0
		Meadowland WF conn	0	6	10	0
		East-West Freeway	0	6	37	72
		Rt. 55 Extension	0	2	13	18
		Rt. 18 Freeway	0	1	9	0
		Rt. 24 Connector	0	1	7	0
		Total	375	111	154	162
	Existing System Incld. 10% for PE	Capacity Improv.	114	383	440	666
		Condition Improv.	20	46	62	49
		Safety Improve.	31	38	52	20
		Misc. (15%)	25	70	83	110
		Total	190	536	637	845
MUNICIPAL AND COUNTY ROADS	Bridges	Non-state Hwy				
		Over NJ Transit	6	23	28	34
		Over Other RR	3	7	9	11
		Total	9	30	37	45
	Local Aid	County	55	66	80	97
		Municipal	25	68	83	101
		Total	80	134	163	198
	Local Needs of High Growth Corridors		0	97	297	397
STATE HIGHWAYS		ANNUAL TOTAL	690	951	1160	1456
		PERIOD TOTAL	2069	3804	4639	5823
MUNICIPAL AND COUNTY ROADS		ANNUAL TOTAL	89	261	496	639
		PERIOD TOTAL	267	1045	1986	2557
ALL ROADS		ANNUAL TOTAL	779	1212	1656	2095
		PERIOD TOTAL	2336	4849	6625	8380

FIGURE 8

PERCENT OF ALL STATE — MAINTAINED BRIDGES IN POOR CONDITION FOR VARIOUS FUNDING LEVELS

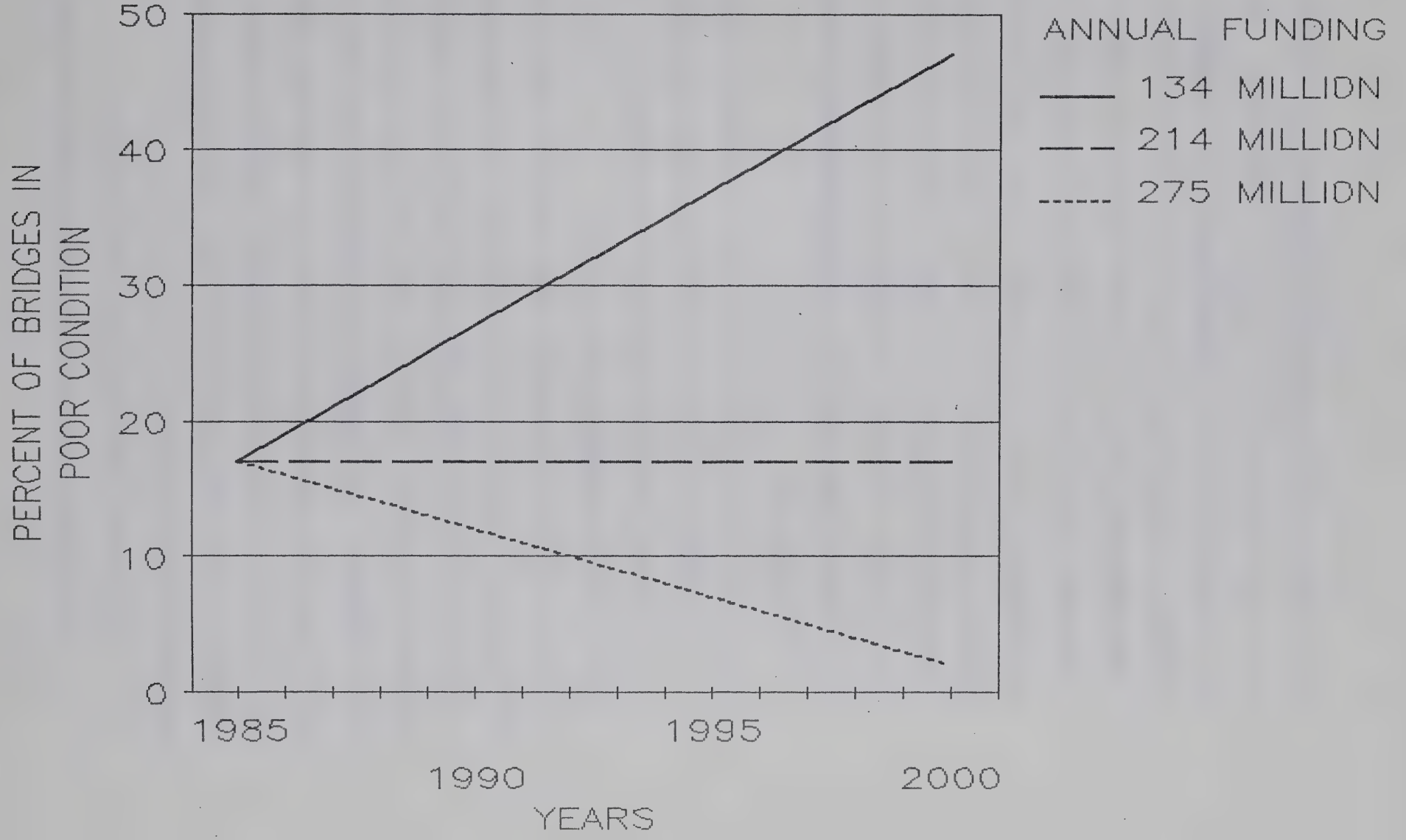


TABLE 12
Optimum Investments
(State Highway System)

	Annual Expenditure	Percent
Bridge	$125m[1.]	18
New Alignment	120[2.]	17
Capacity	315[3.]	46
Condition	40[3.]	6
Safety	30[3.]	4
Miscellaneous	60[3.]	9
	690	100

1. Level of bridge program (state highway bridges only) that is expected to be sustained.
2. A carry-over of new alignment needs is expected from '85-'88 to '89-'91; when the carry-over is added to projected deficiencies of $90 million/yr., the needs would be about $120 million/yr.
3. Figures are rounded off from Table 10.

The level of the Department's capital program that may be achieved is $690 million/yr. Because of the dire consequences of not addressing the bridge reconstruction needs, it is strongly suggested that financial resources be made available for this effort. Hence, the $125 million/yr. for state bridge work should be supported. The suggested level of funding for new alignments should also be supported because essential highway links should be completed and committments to regions should be honored. The $425 million/yr. that is suggested for the existing system needs (from Table 10) is an average annual expenditure for deficiencies that:

- are primarily a backlog of capacity deficiencies, and
- an average of fluctuating deficiencies for condition and safety.

The distribution of expenditures between the four subcategories of the 'existing system' improvements are based on a prioritization model that maximizes the status of the roadway with the volume, for the least cost. In effect, users benefits are maximized and long-term capital costs are minimized.

An interesting observation is evident when comparing the existing system needs for the state highways from Table 8 (current status) and Table 10 (Eliminate Backlog). Even though the funding for the 'current status' is only 60% of the 'eliminate backlog', there is very little difference between the non-capacity improvement categories. In summary, it is suggested that if the funds available for 'existing systems' improvements are reduced, the reduction should be made in 'capacity' improvements.

D. HPMS Investments versus the 1984 Trust Fund

A comparison was made of the HPMS investment on the existing system by deficiency type for the first time period versus the proposed projects for the 1984 Trust Fund. Table 13 shows the percent of the investment by capacity, condition, safety and miscellaneous deficiencies.

TABLE 13

PERCENT OF INVESTMENT BY TYPE OF DEFICIENCY

	1984 Trust Fund	HPMS 1985-1987
Capacity	53	69
Condition	13	12
Safety	29	19
Miscellaneous	5	0
	100	100

The pavement condition investment was similar for both, but HPMS invested a much greater percentage of the funding into capacity improvements at the expense of safety and miscellaneous improvements. The results indicate that pavement condition deficiencies were adequately addressed by the 1984 Trust Fund proposal.

The capacity investments above are comprised of reconstruction to freeway, reconstruction or widening with more lanes and traffic engineering improvements. The condition investments are comprised of resurfacing and pavement reconstruction improvements. Safety investments include resurfacing with shoulder and/or alignment improvements and reconstruction or widening with wider lanes. The miscellaneous category includes lighting, drainage and any additional safety improvement over those listed above.

E. Impacts of Investment Scenarios

1. Deficiencies Funded for Different Investment Scenarios

Table 14 shows the investment on the existing state highway system for capacity, condition and safety improvements for both the "status quo" and the "eliminate the backlog" scenarios as determined by HPMS and modified to include interchanges, bypasses, bridge widenings and preliminary engineering.

TABLE 14

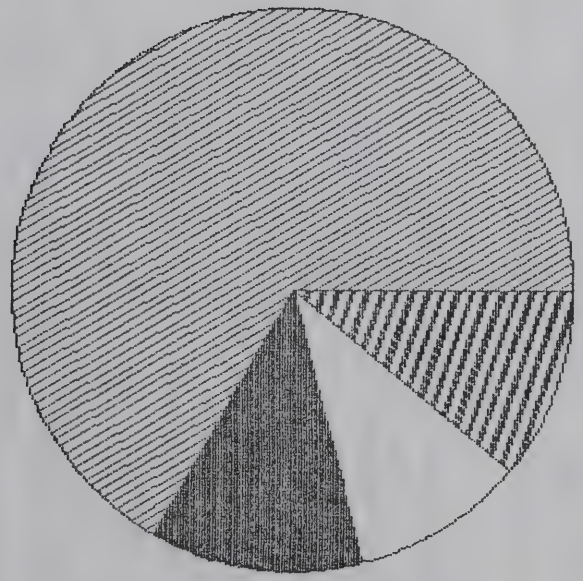
TOTAL INVESTMENT BY FUNDING LEVEL FOR 1985 TO 2000 IN MILLIONS OF 1985 DOLLARS

	Status Quo (60%)			Eliminate Backlog (100%)		
	Miles	Dollars		Miles	Dollars	
Capacity	461	2908	(65%)	709	4278	(72%)
Condition	995	443	(12%)	1037	487	(8%)
Safety	484	363	(10%)	522	400	(7%)
Miscellaneous	--	483	(13%)	--	780	(13%)
Total	1940	3702		2269	5945	

As seen in Table 14 and in Figures 9 and 10, when the investment under the Status Quo scenario is reduced, it is reduced mainly in the capacity improvement category rather than in the condition and safety categories. The reason for this is the capacity improvements are the most expensive to construct and receive lower priority in the ranking process. It is important to remember that care must be given to the pavement condition deficiencies to prevent further deterioration to reconstruction. Figure 10 highlights the distinction in miles of improvement between the 60% and 100% levels of funding. In addition, we can see from this figure that "condition" improvements will only be made on half the system (about 1,000 miles) over the 15 year period. Even though most of the

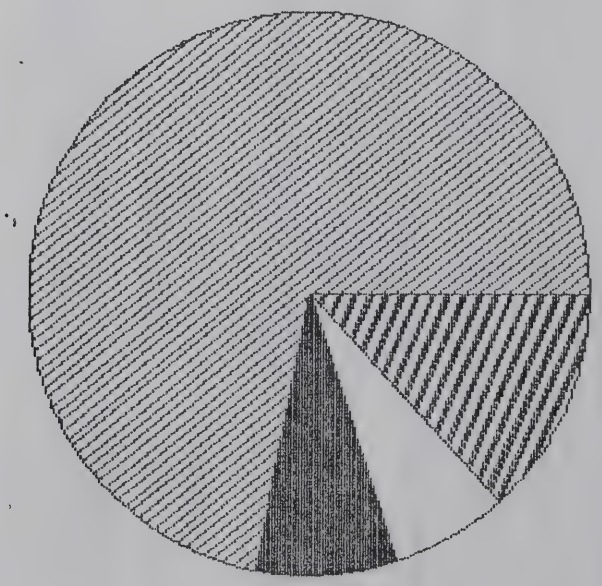
Figure 9

INVESTMENT FOR CAPACITY, CONDITION AND SAFETY BY FUNDING LEVEL (IN MILLIONS OF 1985 DOLLARS)



STATUS QUO

CAPACITY 2414 66.8%
CONDITION 443 12.3%
SAFETY 363 10%
MISC. 395 10.9%

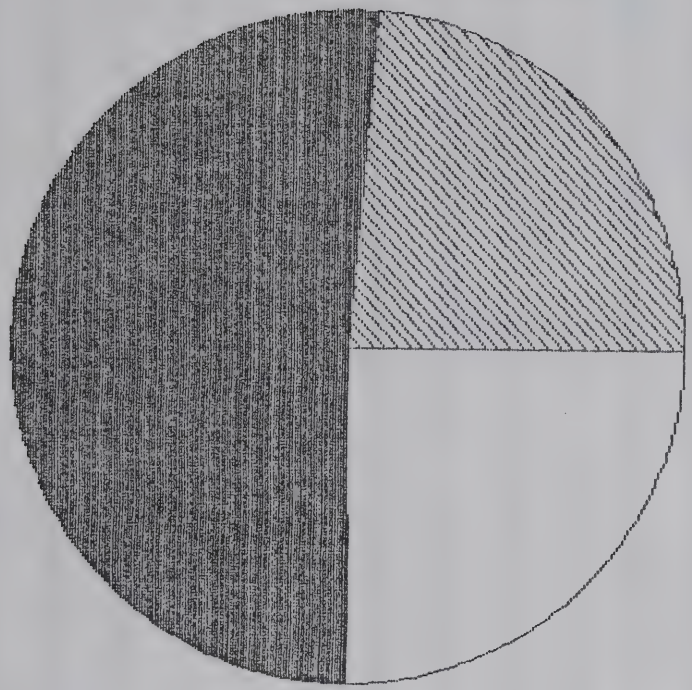


ELIMINATE BACKLOG

CAPACITY 4278 72%
CONDITION 487 8.2%
SAFETY 400 6.7%
MISC. 780 13.1%

Figure 10

MILES OF IMPROVEMENT FOR CAPACITY,CONDITION AND SAFETY BY FUNDING LEVEL

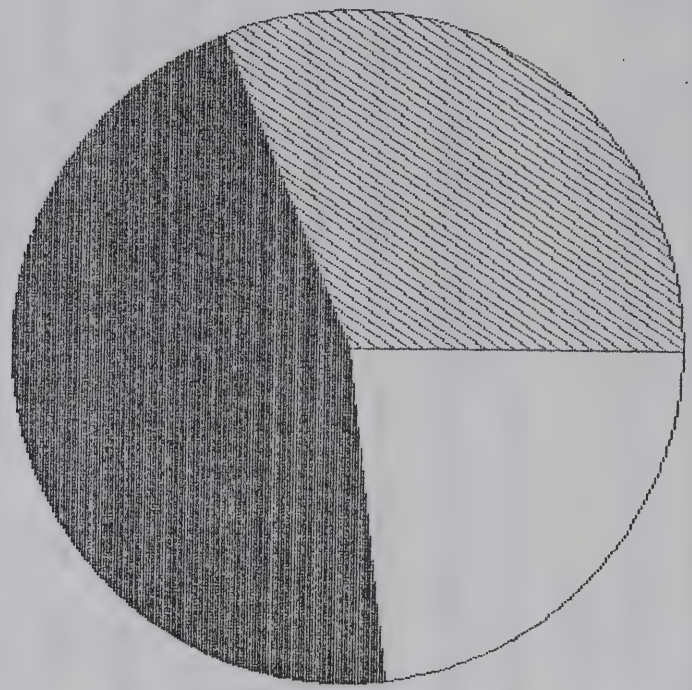


STATUS QUO

CAPACITY 461 23.8%

CONDITION 995 51.3%

SAFETY 484 24.9%



ELIMINATE BACKLOG

CAPACITY 709 31.3%

CONDITION 1037 45.7%

SAFETY 522 23%

system requires pavement rehabilitation in that time frame, the "capacity" and "safety" improvements will take up much of the remainder of the system's pavement rehabilitation needs.

2. Effect of Investment on Deficiency

Figure 11 shows that much of the deficiencies will not be improved at the status quo (60%) and 70% investment levels. As can be seen, the 60% level is nearly horizontal indicating no change in the unimproved deficiencies over the four time periods. This is the level we call "status quo" because it maintains the current backlog of needs. The 70% funding level only slightly decreases the unmet need over time while the 100% funding level decreases the unmet need to near zero in the year 2000. We refer to the 100% level as "eliminate the backlog" since it does invest in all backlogged deficiencies in addition to making improvements to new deficiencies as they occur.

3. Impact of Investment on Highway

Figures 12 and 13 show the effects of the funding levels on pavement condition for interstates and freeways/expressways. Although slight, the 60 percent (status quo) funding level results in an increase in the percent of pavement in poor condition and a decrease in that in good condition over the fifteen years. However, much of the system remains in good condition at the 60 percent funding level because capacity improvements bear the brunt of the reduced funding. As shown in Appendix D, similar changes in distribution occur with the rest of the state highway system.

As can be expected, with the major reduction of investment being made in capacity improvements, traffic flows deteriorate significantly over time. Figures 14 and 15 show that a lower funding level results in a much greater percentage of the urban interstates and freeways/expressways having a high V/C ratio compared to the higher funding level. An important point not to be

Figure 11

DEFICIENCIES NOT IMPROVED BY FUNDING LEVEL
(IN MILLIONS OF 1985 DOLLARS)

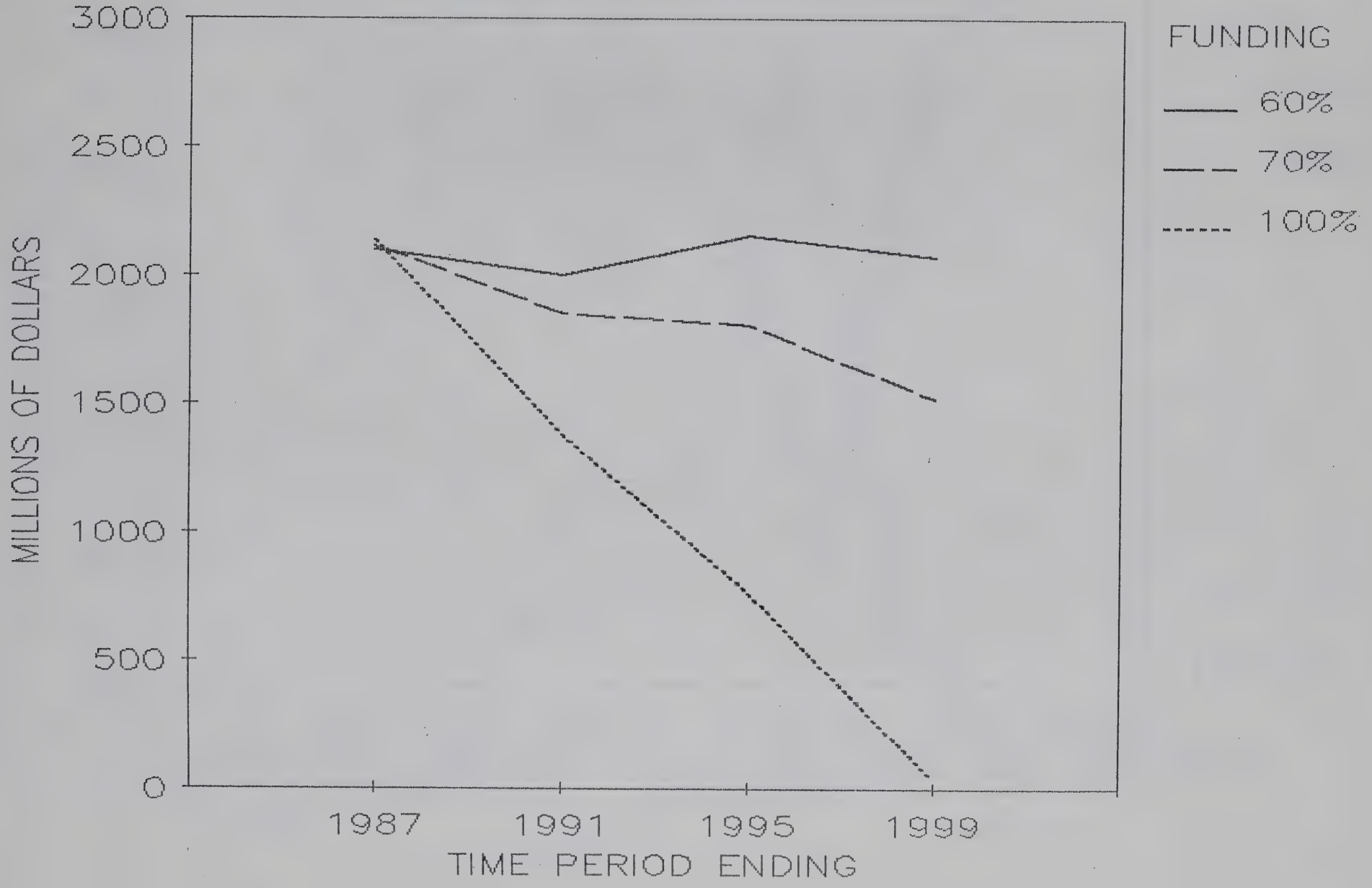


Figure 12

PAVEMENT CONDITION FOR INTERSTATES AND FREEWAYS
IN 1987 AND 1999 AT 100% OF FULL FUNDING

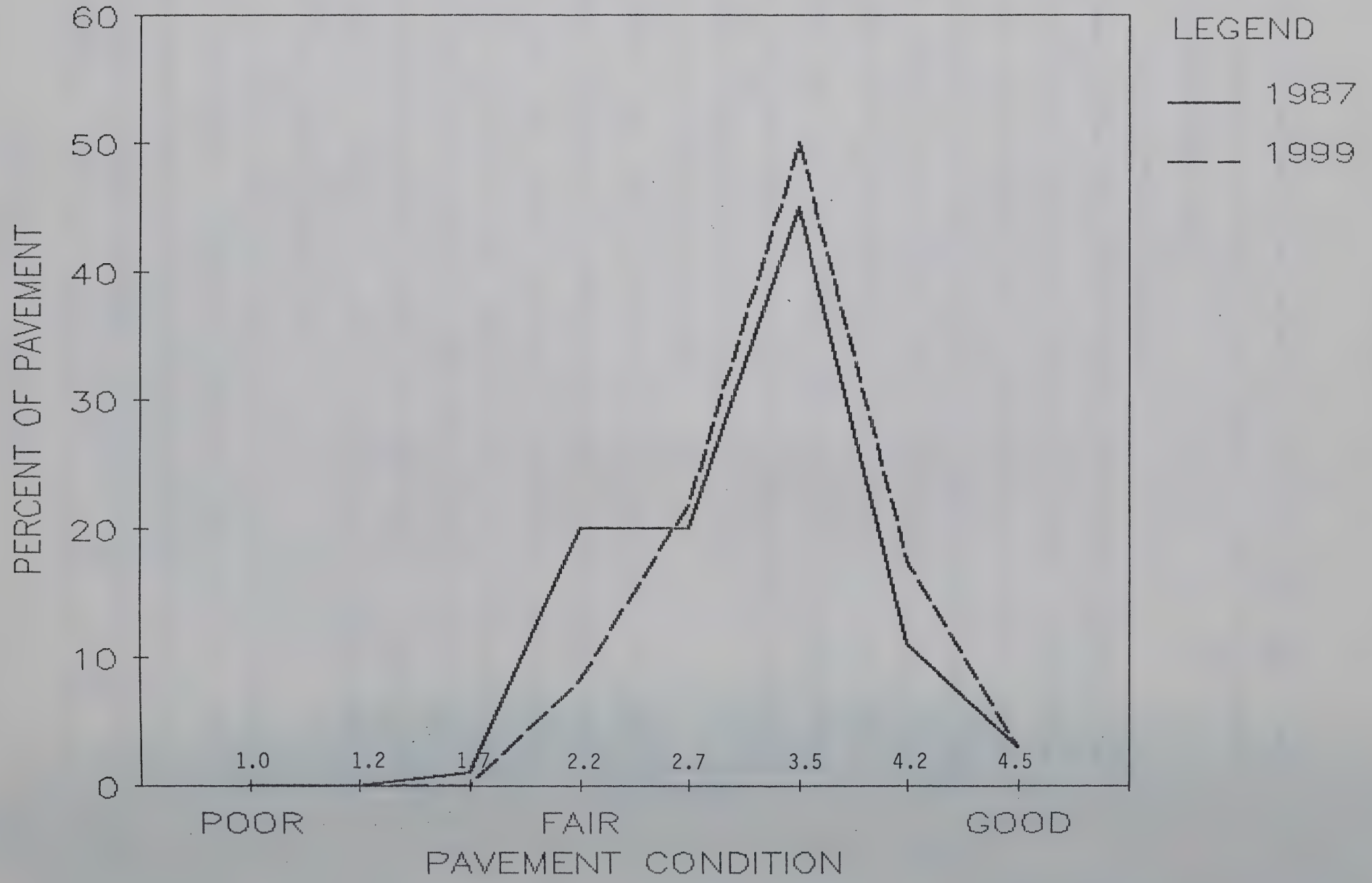


Figure 13

PAVEMENT CONDITION FOR INTERSTATES AND FREEWAYS
IN 1987 AND 1999 AT 60% OF FULL FUNDING

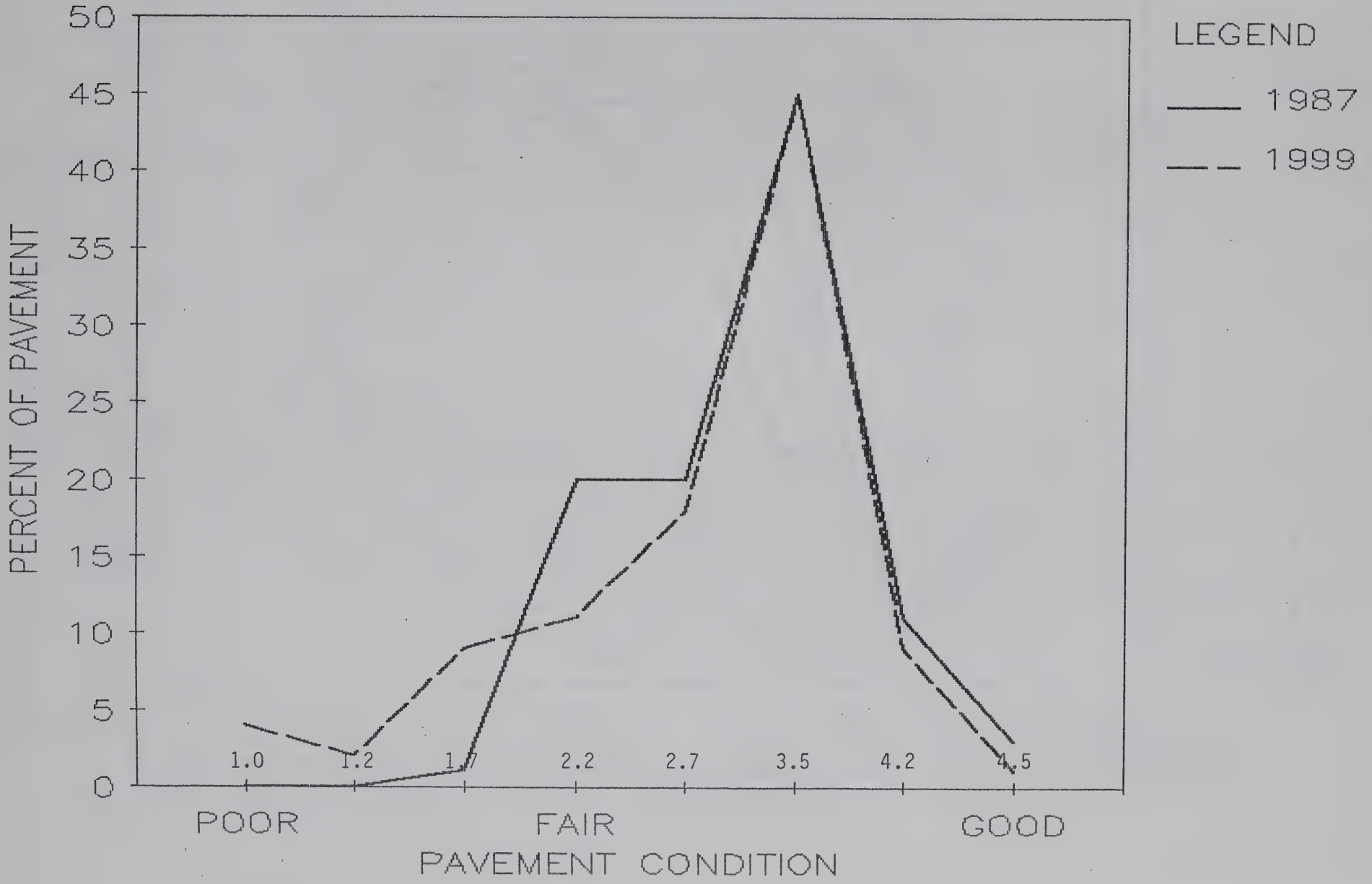


Figure 14

V/C RATIO FOR URBAN INTERSTATES AND FREEWAYS
IN 1987 AND 1999 AT 100% OF FULL FUNDING

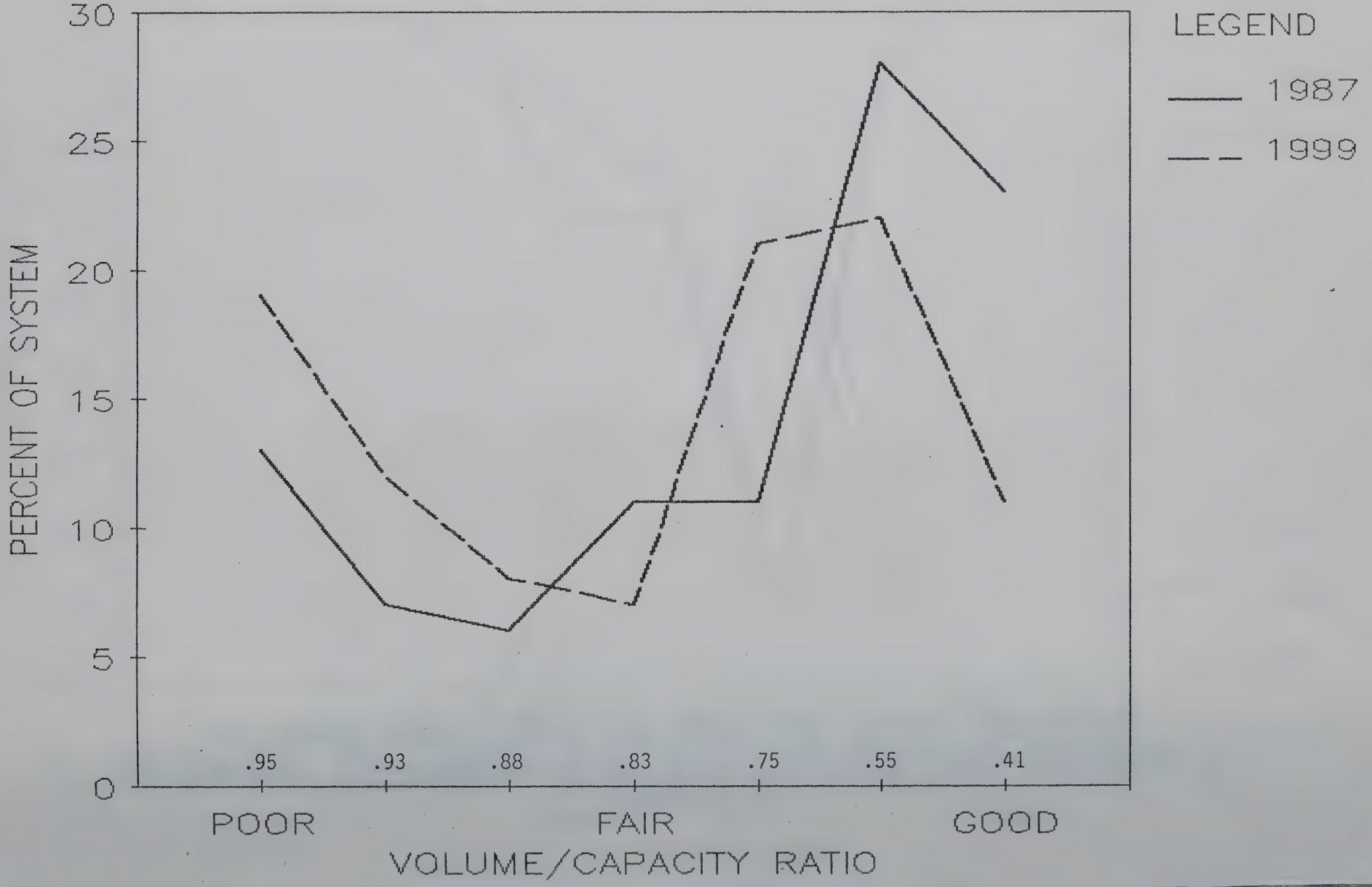
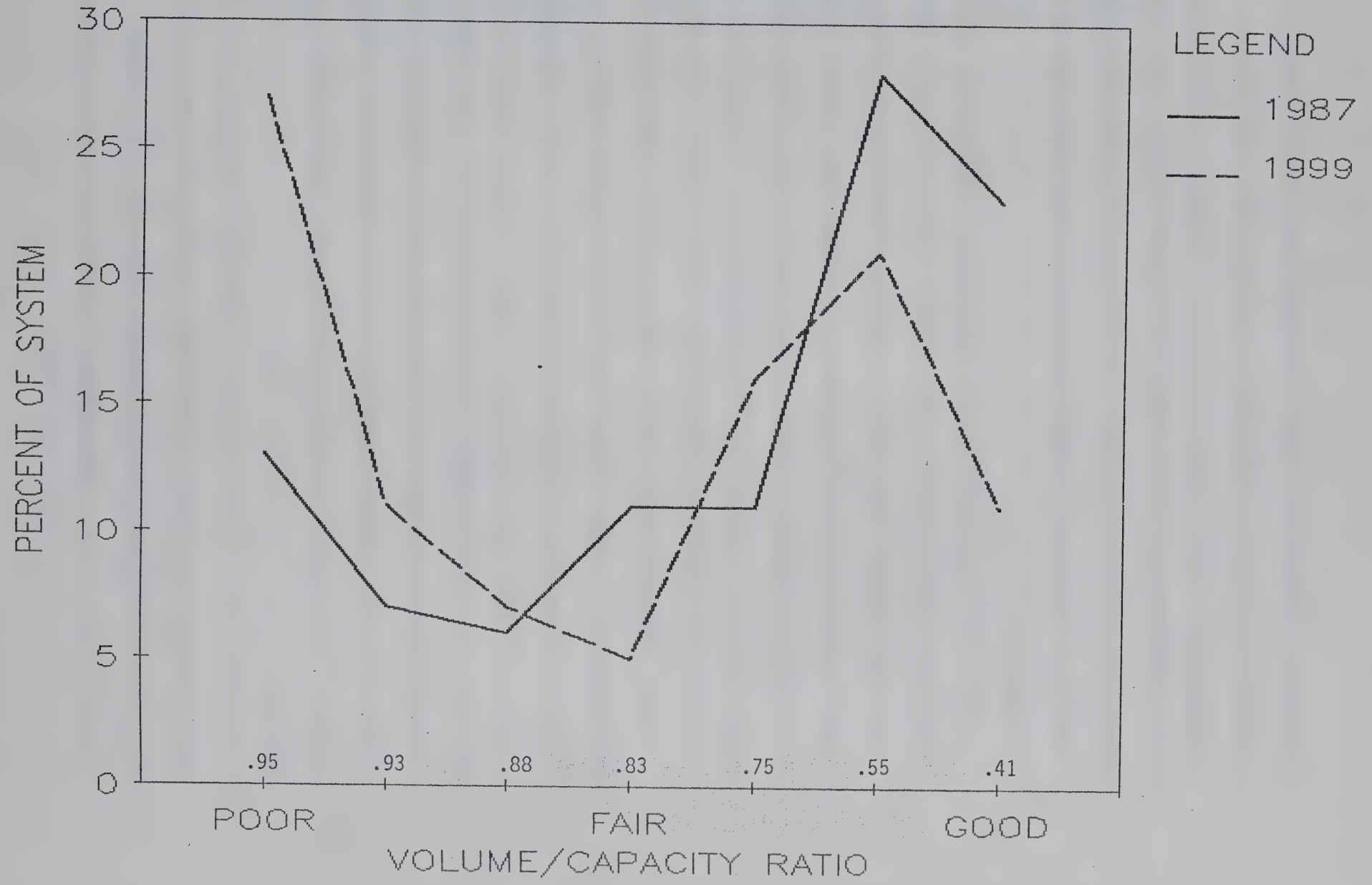


Figure 15

V/C RATIO FOR URBAN INTERSTATES AND FREEWAYS
IN 1987 AND 1999 AT 60% OF FULL FUNDING



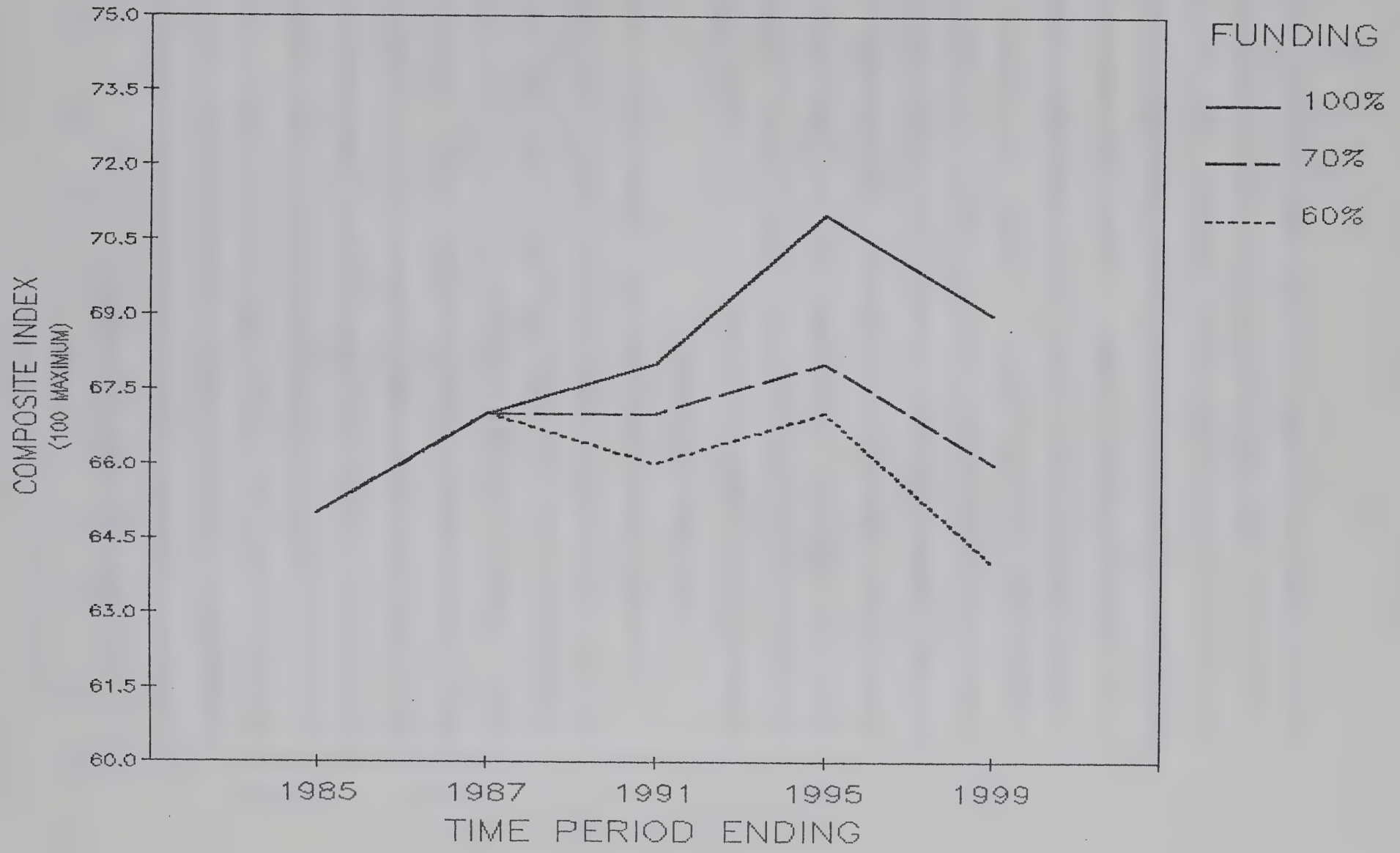
overlooked is the fact that even at the high funding level there is a large increase in the amount of the system that becomes worse. One reason for this worsening, even with funding available, is the existence of widening needs in areas where widening is not feasible. As stated previously, non-traditional capacity improvements will have to be considered, if it is decided to alleviate these capacity problems. A similar effect occurs with rural interstates as shown in Appendix D.

The most comprehensive overall indicator for measuring the impact of investment scenarios is the "composite index." This index is a computation of factors that comprise the condition, capacity and safety asects of the road. Figure 16 depicts the "index" for the three investment levels. The dop in index for the last time period can be explained entirely by a drop in the condition component (which makes up 40% of the composite index). A partial explanation for this drop is found in a comparison of the funding levels that are made over the years. The last period reflected a substantial drop in funding for condition improvements. This does not mean that condition deficiencies existed and were not improved, but simply that the level of investment in condition deficiencies in prior years brought the system to a satisfactory level in the last period. Although the system's condition may have deteriorated, it is still satisfactory. Appendix D shows the trend of each component index. The 100% funding level is the only one that can be relied on to give a sustained improvement to the overall system. The 60% level is showing that the system is worse (overall) than the base year.

Another area in which the impacts of different funding scenarios can be seen is bridges. As has been seen previously, the present level of bridge funding will only slow down the increase in percent of bridges in poor condition. The impacts of this increase in bridges in poor condition are already being felt. For

Figure 16

EFFECTS OF FUNDING LEVEL ON THE TOTAL HIGHWAY QUALITY



example, bridges are being given restrictive weight limits and in some places closed down to vehicle traffic entirely because of their deteriorated condition. This leads to long detours with resultant increases in travel time and costs. Safety is also affected since emergency vehicles can no longer use the bridge and must be detoured resulting in delays in arrival at the scene of emergency situations. Aside from these problems with delay and safety, deteriorated and outdated bridges also cause congestion problems. They, tending to become bottlenecks, limit the maximum capacity of the entire road section to that of the bridge. Detours around these bottlenecks also increase congestion on other highways in the immediate area of the bridge. A funding program set up to maintain the status quo would alleviate the more severe bridge problems annually; thereby, reducing the effect on the entire system. However, it would be necessary for the Department to build up to the level of effort required.

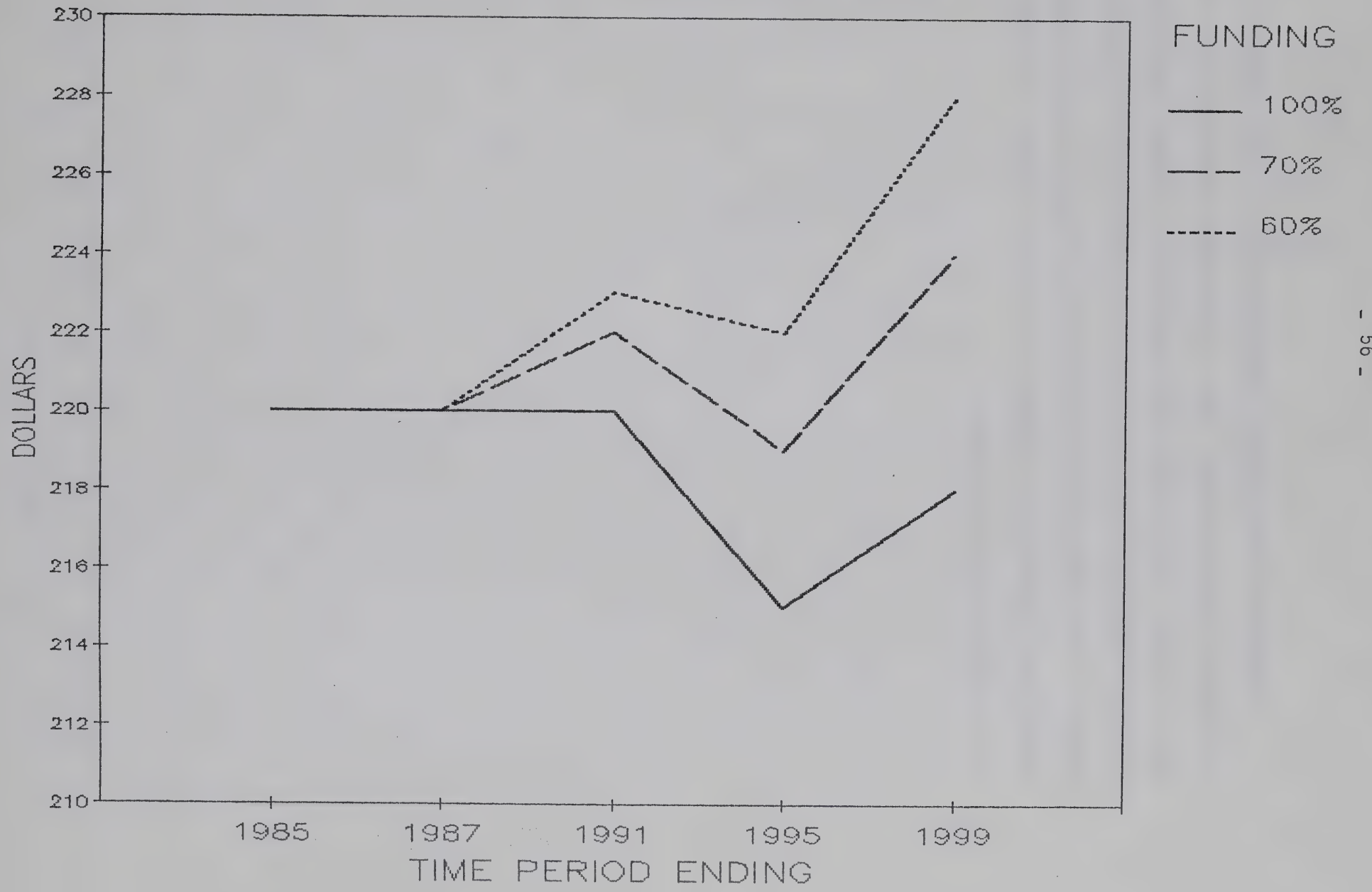
4. Impact of Investment on User

A primary measure of the impact from varying investment levels on the user is the cost of vehicle operation. The higher the level of investment, the less impediment that a driver can expect and, hence, the less costly a trip will be. Figure 17 graphically highlights the differences over the next 15 years in the cost of vehicle operation on the state highway system. Obviously, the full funding level (100%) shows the least cost to drivers. But even at the full funding level, the cost of operation isn't as low as it could be because of those roadway locations where capacity improvements can't be made. In fact, the result of not being able to make these capacity improvements is evident in the last time period (Figure 17) where the operating costs for full funding start to increase. The aggregate difference in cost between the 60% and 100% funding levels in the year 2000 is estimated to be $280 million/year.

Figure 17

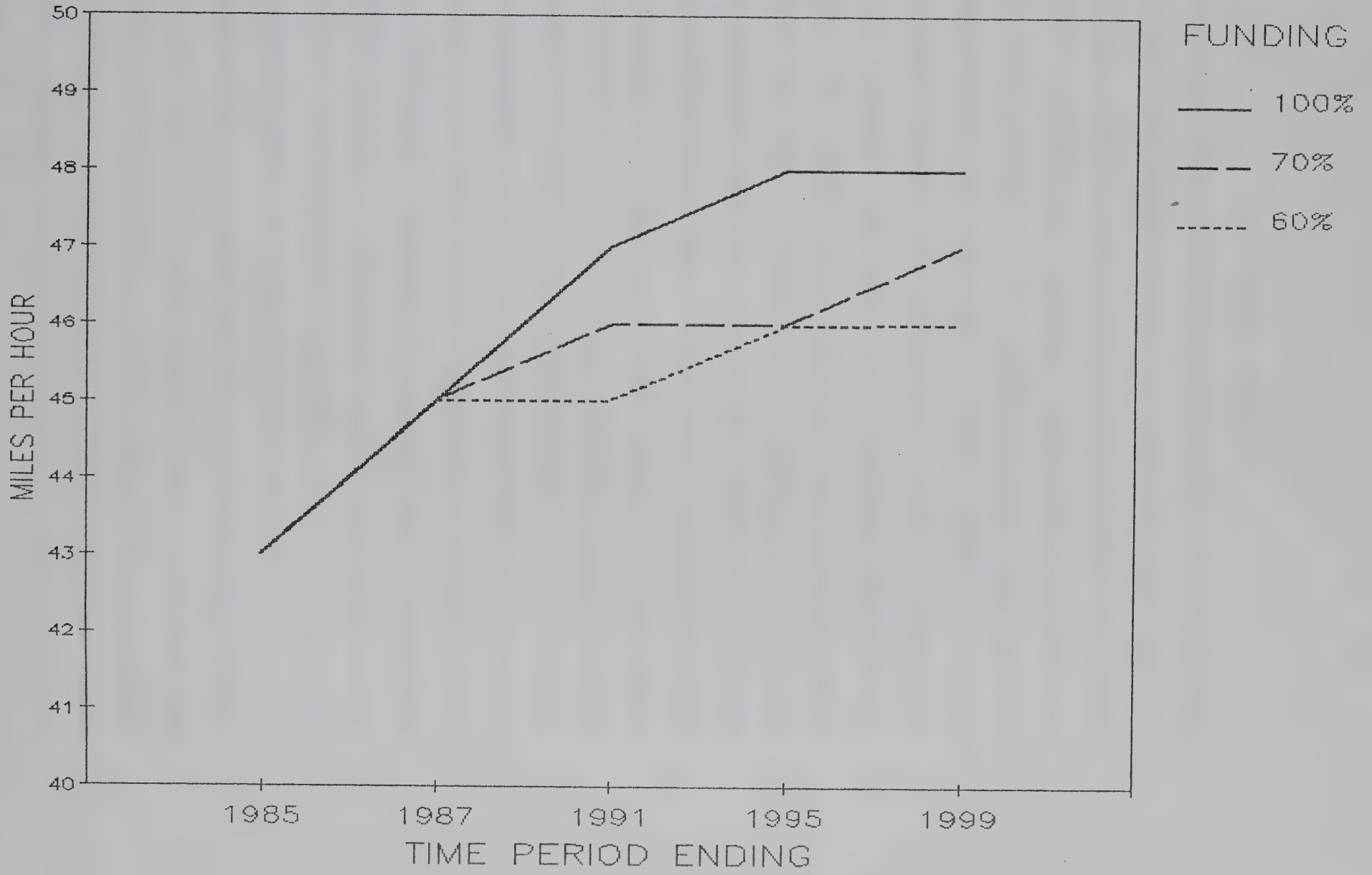
EFFECTS OF FUNDING LEVEL ON OPERATING COST

(IN DOLLARS PER 1000 VEHICLE MILES)



A corrollary to the operating cost trend is the operating speed trend for the different investment levels. Figure 18 shows this difference for he rural highway system. Again, because of the large number of roadway segments that cannot be widened, the difference between the speed curves is not expected to increase. If the models ere extended into the 21st century, we may find that the average speed curves would converge and eventually decrease. Appendix D shows the curve for the urban system.

Figure 18
EFFECTS OF FUNDING LEVEL ON AVERAGE RURAL HIGHWAY OPERATING SPEED IN MILES PER HOUR



VI. FUNDING SOURCES

The foregoing discussion of deficiencies clearly demonstrates that funding requirements for the foreseeable future are even greater than what Trust Fund I provided. Moreover, with Federal funding likely to diminish, the need for state funding will become even more pronounced. Staff preparing this needs report recognize that the formulation of a legislative funding strategy necessarily involves considerations other than needs, not the least of which is the overall fiscal situation in the state in the face of Gramm-Rudman. A smaller state surplus, and the specter of Federal cuts in a multitude of areas (aimed at reducing the Federal deficit) will undoubtedly make it more difficult to argue for sustained and increased transportation funding. Nonetheless, it must be argued that a continuation of the Trust Fund Program, supplemented by the TDD (Transportation Development Districts) legislation, that has been formulated as part of the growth area management legislative package, is urgently needed. Table 16 summarizes the total dollar needs which are warranted for the four year period FY 88-91, drawing upon the previous discussion of needs. The extent of state dollars required will depend upon the final outcome of the new Federal transportation authorization bill, and the expectation of developer revenues which the TDD legislation will yield, if it is enacted. These are matters which the overall workers group on the legislative strategy will need to come to some judgment about. At this juncture, Planning and Research staff are only prepared to offer a general suggestion concerning high growth corridors.

In general, any future funding plan should minimize depending on Federal funds in growth areas. The Federal process is simply too regimented and inflexible to adapt it to the "give and take" of developer negotiations and the need to segregate improvements from overall corridor considerations. In the Federal view, everything relates to everything else, and segregation is viewed skeptically.

TABLE 15

TOTAL ANNUAL FUNDING REQUIREMENTS
FOR PERIOD '88-'91
(In Millions of Dollars)

System	Total
State	690[1.]
County/ Municipal	135[2.]
Local (High Growth)	80[3.]
Total	905

NOTES:

1. Refer to Table 12, as discussed in the text of Section V.C.
2. Refer to Table 1B -- $80 million in Local Aid and $9 million in bridges ($5 million is from federal sources). Maintain funding at this level.
3. Refer to Table 1B.

PART II. PUBLIC TRANSIT

I. SUMMARY FOR PUBLIC TRANSIT

NJ TRANSIT has made considerable progress in the six years that it has had control of most of the intrastate bus and rail operations. Through the current fiscal year they have committed over $1.5 billion to the capital needs of the public transit system of the state.

Realizing the importance of constant maintenance, keeping abreast of accelerating land developments and projecting travel demand increases in the future, the Corporation has estimated deficiencies of about $3 billion to the year 1992. This is an estimate made on known current developments; conditions change rapidly and could force these deficiencies to be much more costly.

II. ACCOMPLISHMENTS

The formation of NJ TRANSIT in October 1979 raised the hopes and expectations of government, the Department of Transportation and the commuters of the state. All intrastate commuter rail service was assumed by the Corporation and most of the commuter bus service. In the six years since they've been in operation, NJ TRANSIT has made a capital investment of over $1.5 billion into the bus and rail systems under its jurisdiction.

TABLE 16

CAPITAL FUNDS INVESTED

(Public Transit System)

$697 million	Completed Rail Projects
251 million	Completed Bus Projects
591 million	Projects Underway

Funds used to achieve this record have had several sources, which can be grouped as follows:

$1116 million	Federal Grants
220 million	Port Authority of New York and New Jersey
203 million	Bonds, Trust Fund, State Tax

Federal grant funds have been diminishing over time and Port Authority of New York and New Jersey funds may end with the current capital program. NJ TRANSIT's future capital needs will have to be satisfied to keep the bus and rail rolling stock and facilities maintained.

III. DEFICIENCIES

The auspicious start that NJ TRANSIT has made in a capital program has reversed the downward direction of public transit ridership by improving rolling stock and facilities. It isn't enough to merely improve; unless the maintenance of a system is an annual priority, conditions will deteriorate quickly. Further demands are made on the transit system by virtue of an ever-increasing need for transportation. This need is imposed by increased employment in New York, primarily, and Philadelphia. Although these employment centers are outside the state, it is New Jersey that will be the primary source of supply.

The table in Appendix F lists projected capital needs to the year 1992 to address several key objectives:

1. It relieves trans-Hudson vehicular and commuter congestion problems, and probably obviates the need for a new river crossing;
2. It resolves Newark International Airport access problems;
3. It provides a waterfront transportation system that will facilitate maximum waterfront development in a way that is compatible with community and environmental priorities, and that will preserve trans-Hudson capacity on key approach facilities; and,
4. It enables New Jersey's public transportation network to meet anticipated growth and development for the next generation.

These deficiencies are summarized as follows:

Program	Cost
Base	$1277 million
Capacity	590-1005 million
New Initiatives	950 million
Total	$2817-$3232 million

The range in annual expenditures estimated through 1992 is from $360 million to $620 million, substantially higher than the current capital program.

As with any long-term projection of capital needs, there is no means of determining where other major growth areas will occur. Those that are highlighted have been either known about for years or have developed quickly within the past five years. New Jersey is prime for added growth because of its market access, transportation system and employment resource. To think that the projection of deficiencies that we see today for the next six years, is complete, is short-sighted.

APPENDICES

APPENDIX A

ASSUMPTIONS USED TO MAKE BRIDGE PROJECTIONS

1. Present condition of bridges as per New Jersey Department of Transportation's Bridge Survey (10/28/85) from Office of Engineering Services, Bridges and Structures.
2. All bridges in good condition (sufficiency rating $>$ 80) will deteriorate to fair condition in 20-year period.
3. All bridges in fair condition (sufficiency rating between 80 and 50) will deteriorate to poor condition (sufficiency rating $<$ 50) in 15-year period.
4. Annual funding is applied to rehabilitation of bridges in poor condition.

APPENDIX B

NEW ALIGNMENTS AND LOCAL NEEDS

	1985-87	1988-91	1992-95	1996-1999
78	15	--	--	--
78	63	--	--	--
287	344	11	--	--
295	40	--	--	--
295	71	--	--	--
295	54	--	--	--
295	19	--	--	--
17	5	40	27	--
18F	62	--	--	--
20	18	--	--	--
21	5	20	30	--
24	60	--	--	--
29/129	21	--	--	--
33	13	15	--	--
40	1	7	--	--
55	89	--	--	--
90	24	--	--	--
92	29	40	30	--
129	1	12	20	--
169	19	--	--	--
169	31	--	--	--
169	21	--	--	--
185	22	--	--	--
Som. Express.	5	30	40	--
Carteret Ind. Rd.	8	--	--	--
Eisenhower Pkwy.	20	32	--	--
Sparta-Munson Bypass	9	--	--	--
HRWF N-S Route	8	64	60	--
ConRail Reloc.	29	5	--	--
169/185 Short Fall	20	20	--	--
Meadowland-WF Conn.	--	20	27	--
East-West Fwy.	--	20	100	160
55 Ext.	--	6	34	40
18F	--	5	25	--
24 Conn.	--	2	18	--

APPENDIX C

METHODS FOR DETERMINING DEFICIENCIES ON THE EXISTING SYSTEM

1. Highway Performance Monitoring System (HPMS)

HPMS is a computer model developed by the Federal Highway Administration (FHWA) to project highway needs into future years. It also computes the impacts of making various investment strategies to meet all or part of the needs. The impacts or effects include vehicle performance and highway performance measures. These measures include operating speed, volume to capacity ratios, pavement condition and an overall measure of the combined capacity, condition and safety components of the system. New alignment needs and bridge deterioration needs are not included in HPMS and must be considered separately.

To perform the above functions, a listing of all state highways was prepared including an inventory of physical and operating characteristics. HPMS projects pavement deterioration and traffic growth using values developed by New Jersey Department of Transportation staff for the highways. Using the inventory and projections, HPMS identifies capacity, condition and safety problems on an annual basis into the future. After the needs have been identified, improvement types and costs are selected to return the road to a level meeting design standards. The sections are then ranked by a cost-effectiveness analysis with the most cost-effective section being the first to be funded. Sections are funded until no additional deficiencies are left or until funds are depleted.

One of the important points to be learned from the analysis of needs into the future is that lack of funding for pavement condition needs early-on will result in much larger future needs. This happens because, when poor pavement is not resurfaced, it deteriorates rapidly to the point where reconstruction is needed at a significantly higher cost.

2. Investment Levels to be Considered

Several considerations can be used to determine that level of investment that should be used as part of a funding proposal. Probably the most simple is to continue at the current level regardless of how well it meets future needs. A better method is to select some level of system status and target that level. Two levels of system status which are of importance are the current status and targeting a future date to eliminate the full backlog of needs. Using HPMS, a level of funding necessary to achieve the above status levels can be selected. It is also possible to show the effect over time of the current level of funding on system status.

The period of time to be projected was selected to be 1985 to 1987, 1988 to 1991, 1992 to 1995, and 1996 to 1999 -- a total of fifteen years. The first period is that time in which most of Trust Fund I monies will be expended followed by three 4-year periods. The second period represents an estimate of the time to be included in a subsequent Trust Fund proposal. The following periods are used to show the effect the various funding levels will have in the longer term and should be used for planning in a stable funding atmosphere.

3. Unaccounted for Needs

As mentioned above, HPMS does not consider bridge "deterioration" needs. Besides those, we did not include bridge widening costs where roads on either side of the bridge are widened. Also, it was decided to limit the model's ability to reconstruct a road to a freeway so that such an improvement could be limited to where policy says it should be considered. This was done because the New Jersey Department of Transportation has made some decisions on where freeways should not be considered. Finally, HPMS does not consider alternative solutions where physical constraints in

isolated areas prevent widening. Frequently, this is done because small towns in the middle of a rural highway to be widened would prevent such widening. In such a situation, a bypass around the town would be the probable solution.

To consider the above limitation to HPMS, a manual review of sections of road needing widening was made. A cost of $1 million per bridge was added for those bridges within a widened section of road. A cost of approximately $20 million per interchange and a cost of $5 million per circle cut-through was added where such improvements are needed as determined by Planning's review of the widening improvements. For bypasses, an estimate of $10 or $20 million was used for where the bypasses were determined to be necessary.

HPMS does not provide for some miscellaneous improvements such as guiderail, lighting, delineation treatments and others. Based on a review of the proposed projects in Trust Fund I, an additional 15 percent of system investment was added to account for such improvements. The improvement costs used in HPMS did not consider the costs for engineering (PE) and an additional ten percent of the investment was added to account for PE.

An example of the total cost of a capacity deficiency in the system is comprised of:

1. HPMS capacity deficiency cost, plus
2. Interchanges, bridge widenings, bypasses, plus
3. PE (ten percent of 1. and 2.).

4. Constrained Widening Needs

One of the parameters identified for HPMS is the number of lanes that can be widened for a road section. The number can be from no-lanes to

unlimited lanes. A review of the highway photolog was made and the appropriate value was assigned. When HPMS performs the annual analysis into the future, it identifies a capacity problem when the V/C ratio or operating speed indicate a capacity problem. HPMS then determines a 20-year design volume and determines the number of lanes to be added. If no lanes are permitted to be added, no widening improvement is selected. If less than the needed number of lanes can be added, that number is selected.

From the above, it can be seen that widenings which are selected may not fully meet the needed capacity addition and other needed widenings will not be selected at all. The cost of widening not selected for either reason can be determined by eliminating all widening restrictions in the HPMS data base and comparing the total capacity dollar need with the constrained dollar need. The miles affected can only be determined by a manual review of each section comparing those sections showing no capacity improvements but having a very poor capacity status.

APPENDIX D

HPMS GENERATED IMPACTS ON THE EXISTING SYSTEM FOR DIFFERENT FUNDING SCENARIOS

The following figures show the effect of funding levels over time for pavement condition, V/C ratio, operating speeds and safety and capacity indices. These figures show how each of the factors is adversely affected by reduced levels of funding below that required to improve all of the deficiencies on the existing system.

Figures 19 and 20 show the effects for non-interstates/freeways on pavement condition. At the 60% funding level much more of the pavement is at a poor rating, while less is at a good rating by 1999.

Figures 21 and 22 show how the rural interstate will have much more of the mileage above a V/C ratio of .5 if funding is limited to the 60% level. At 60% funding 63% of the system is above .7 V/C, while at 100% funding approximately 11% is above .7 V/C.

Figures 23 and 24 show the effect of funding level over time on V/C ratio for rural minor arterials. As can be seen, the 60% funding level will substantially increase the percent of roadways over .8 V/C.

One way of measuring the pavement condition, capacity condition and safety condition of a road is by an index. The index is a weighted measure of what condition the road has. Figures 25, 26 and 27 show the effects of funding level on such an index orr pavement condition, safety and capacity. As can be seen, the lower funding levels will cause worsened conditions over time compared to full funding.

Figure 19

PAVEMENT CONDITION FOR NON—INTERSTATES OR FREEWAYS
IN 1987 AND 1999 AT 100% OF FULL FUNDING

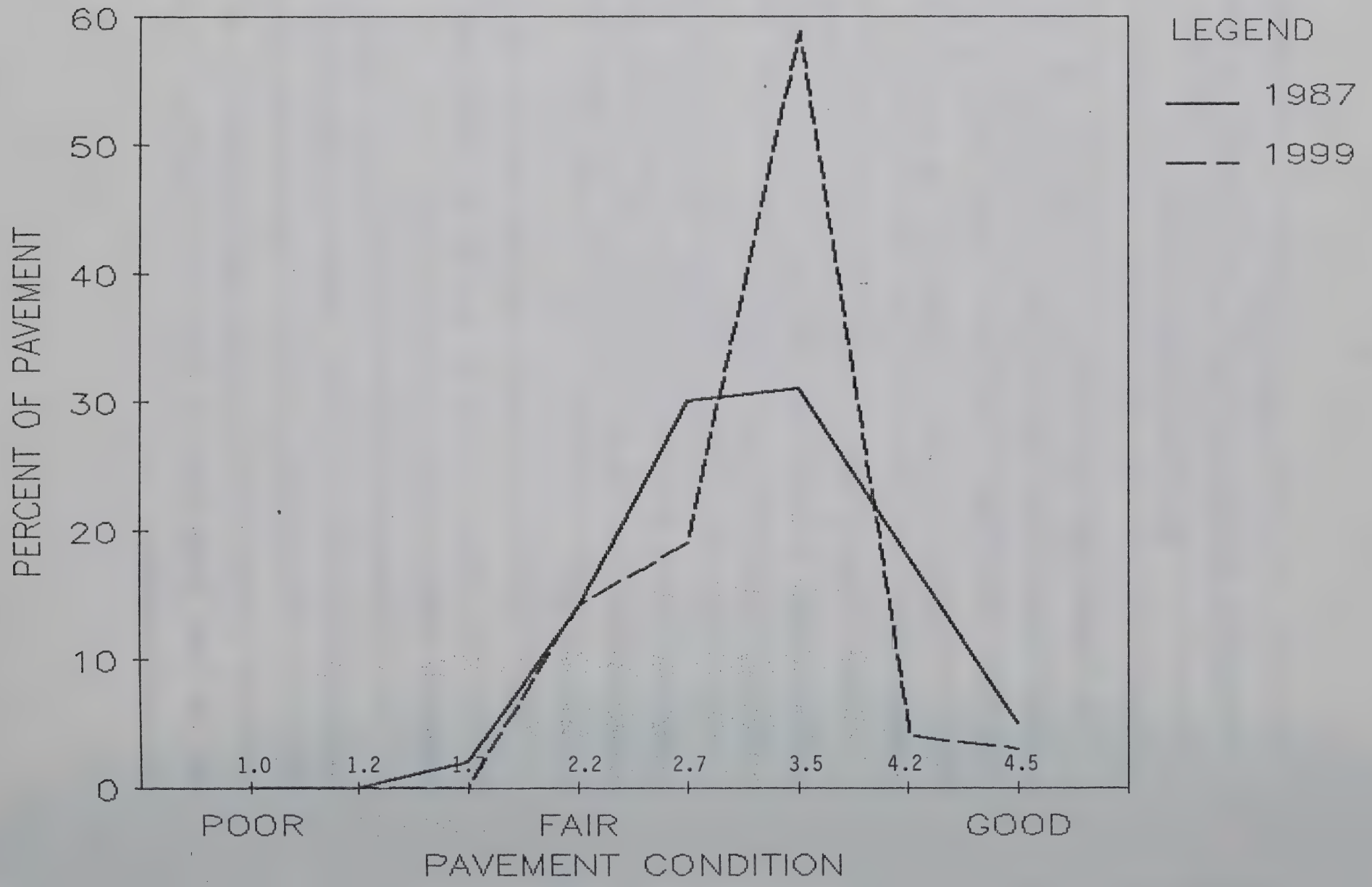


Figure 20
PAVEMENT CONDITION FOR NON—INTERSTATES OR FREEWAYS
IN 1987 AND 1999 AT 60% OF FULL FUNDING

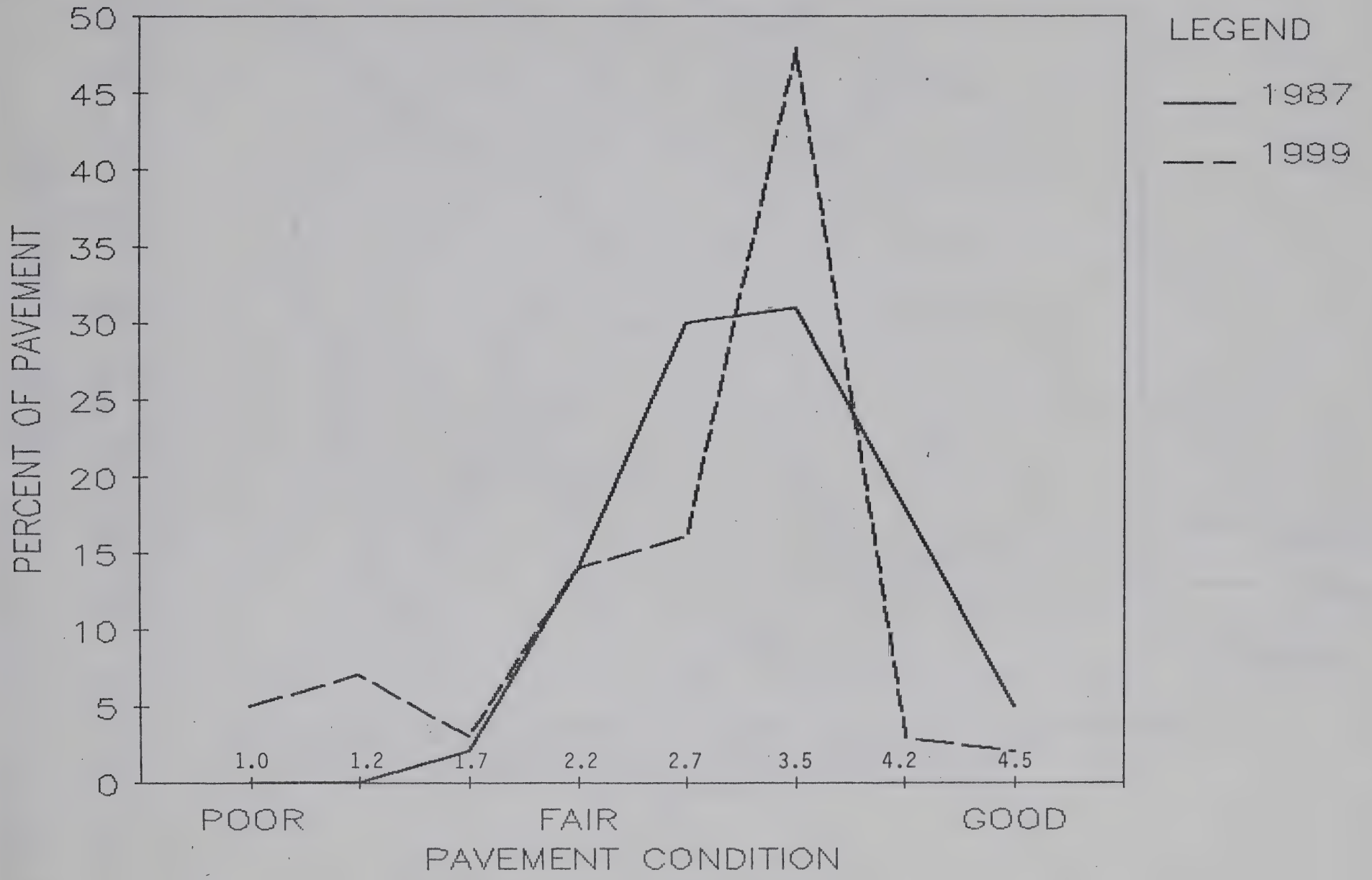


Figure 21

V/C RATIO FOR RURAL INTERSTATES
IN 1987 AND 1999 AT 100% OF FULL FUNDING

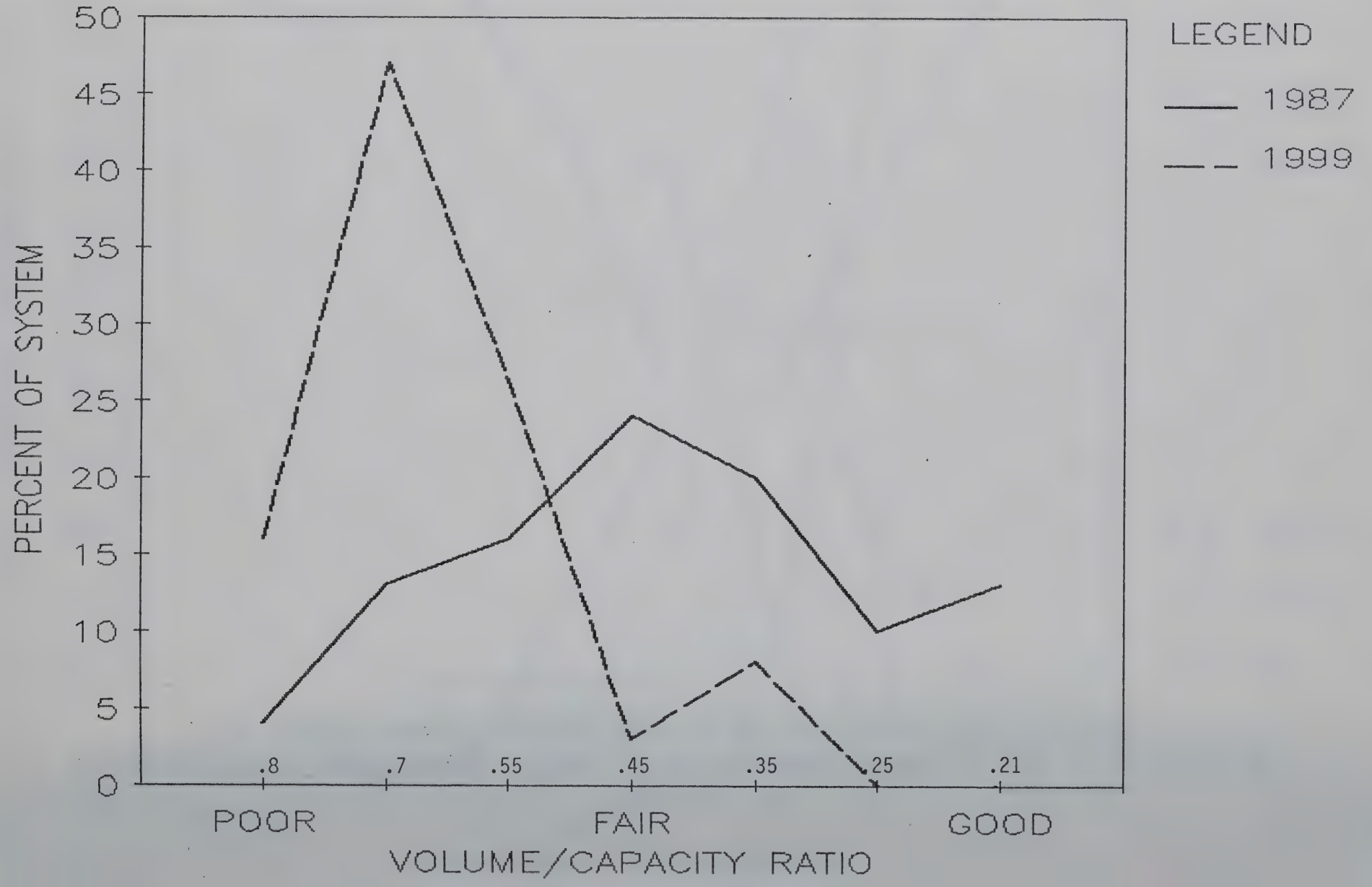


Figure 22
V/C RATIO FOR RURAL INTERSTATES
IN 1987 AND 1999 AT 60% OF FULL FUNDING

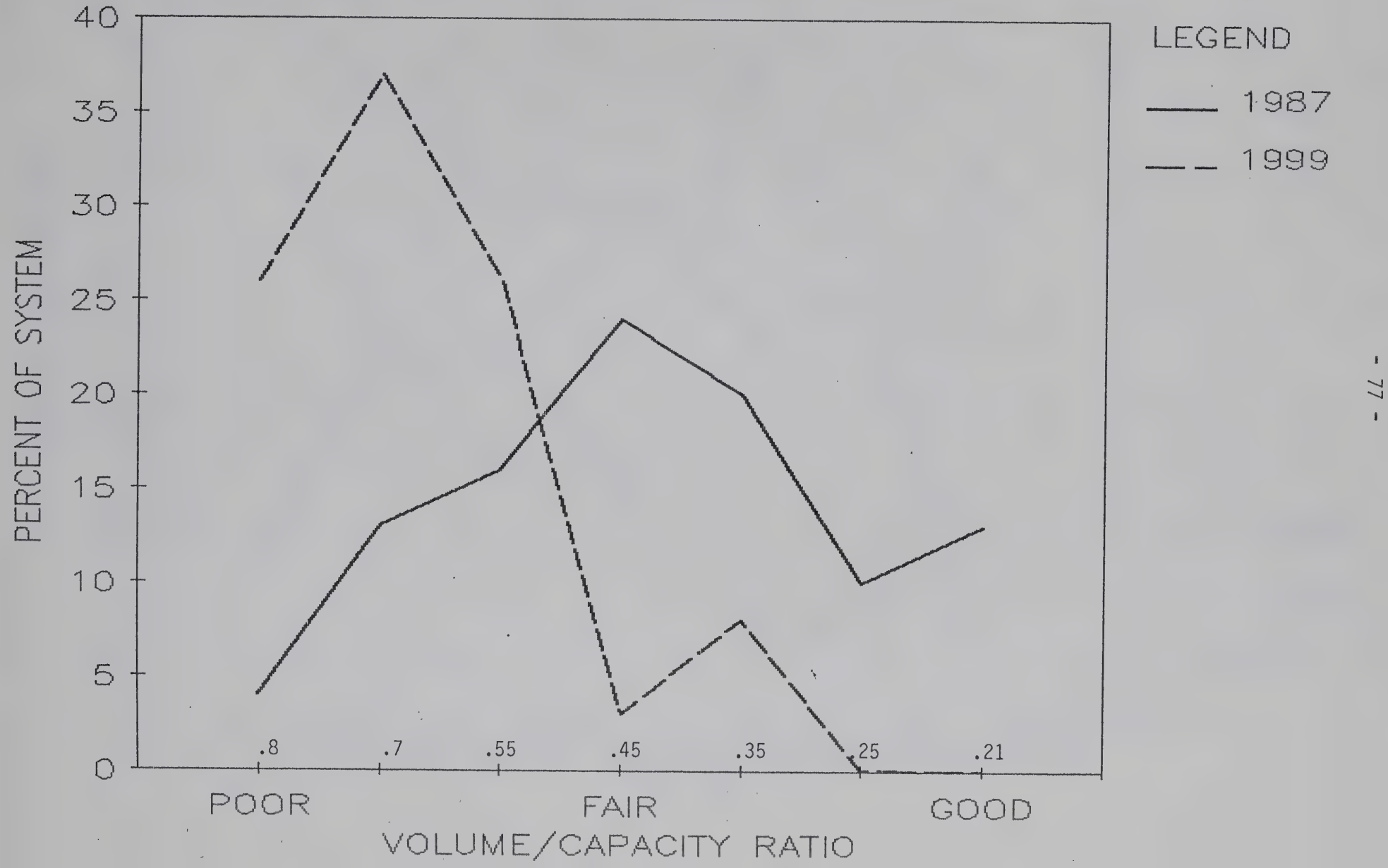


Figure 23
V/C RATIO FOR RURAL MINOR ARTERIALS
IN 1987 AND 1999 AT 100% OF FULL FUNDING

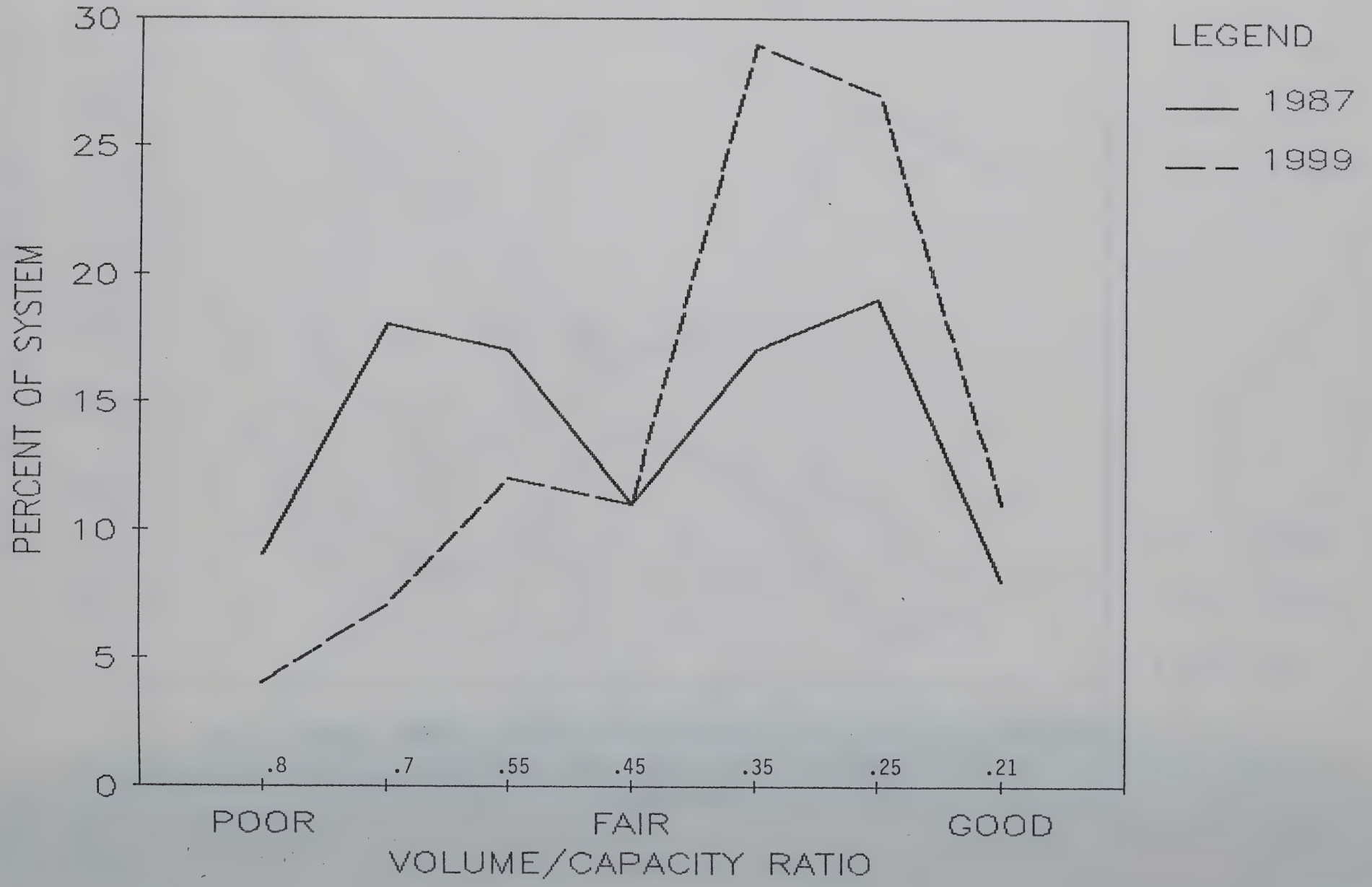


Figure 24
V/C RATIO FOR RURAL MINOR ARTERIALS
IN 1987 AND 1999 AT 60% OF FULL FUNDING

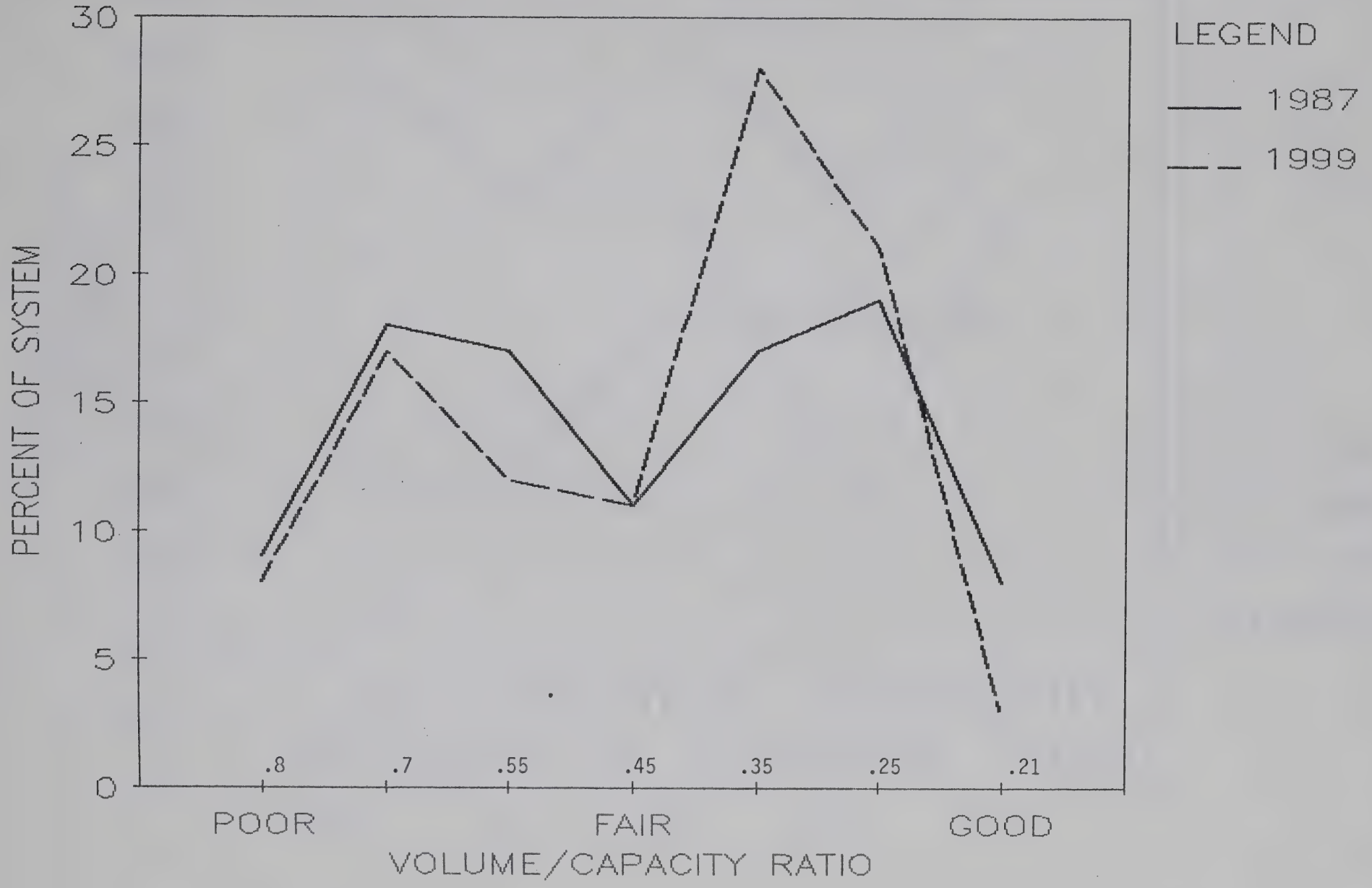


Figure 25

EFFECTS OF FUNDING LEVEL ON PAVEMENT CONDITION

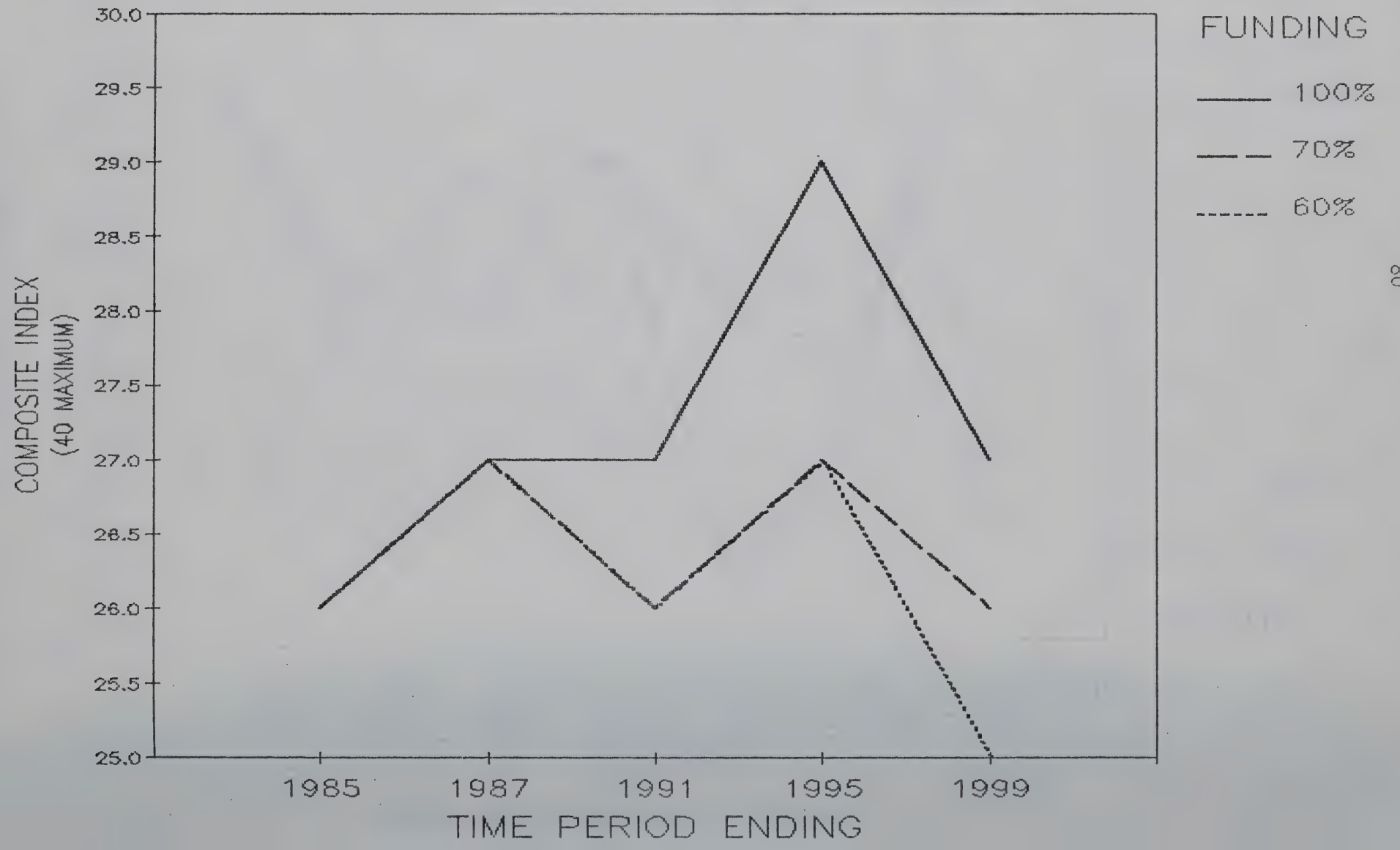


Figure 26
EFFECTS OF FUNDING LEVEL ON SAFETY INDEX

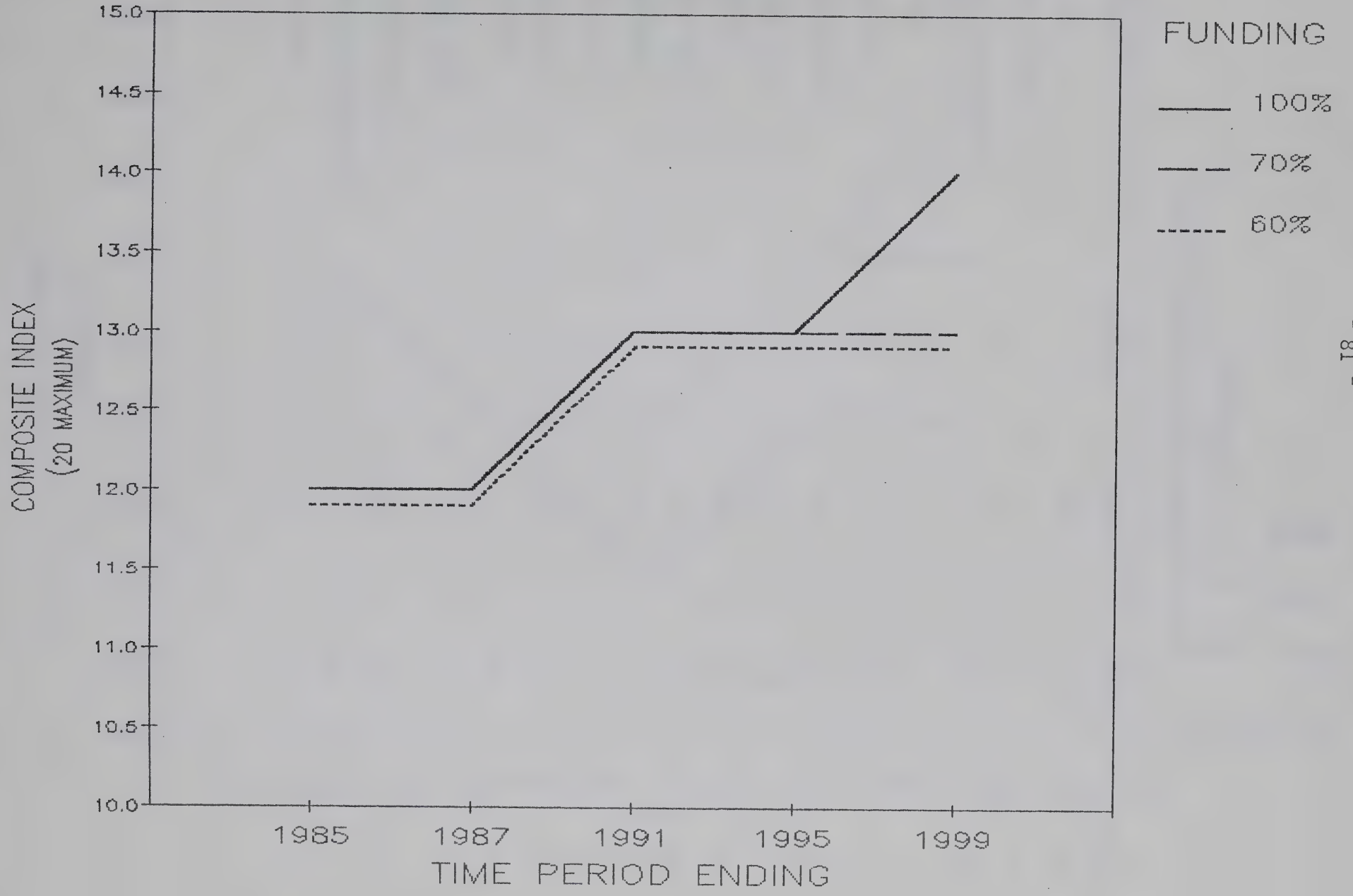
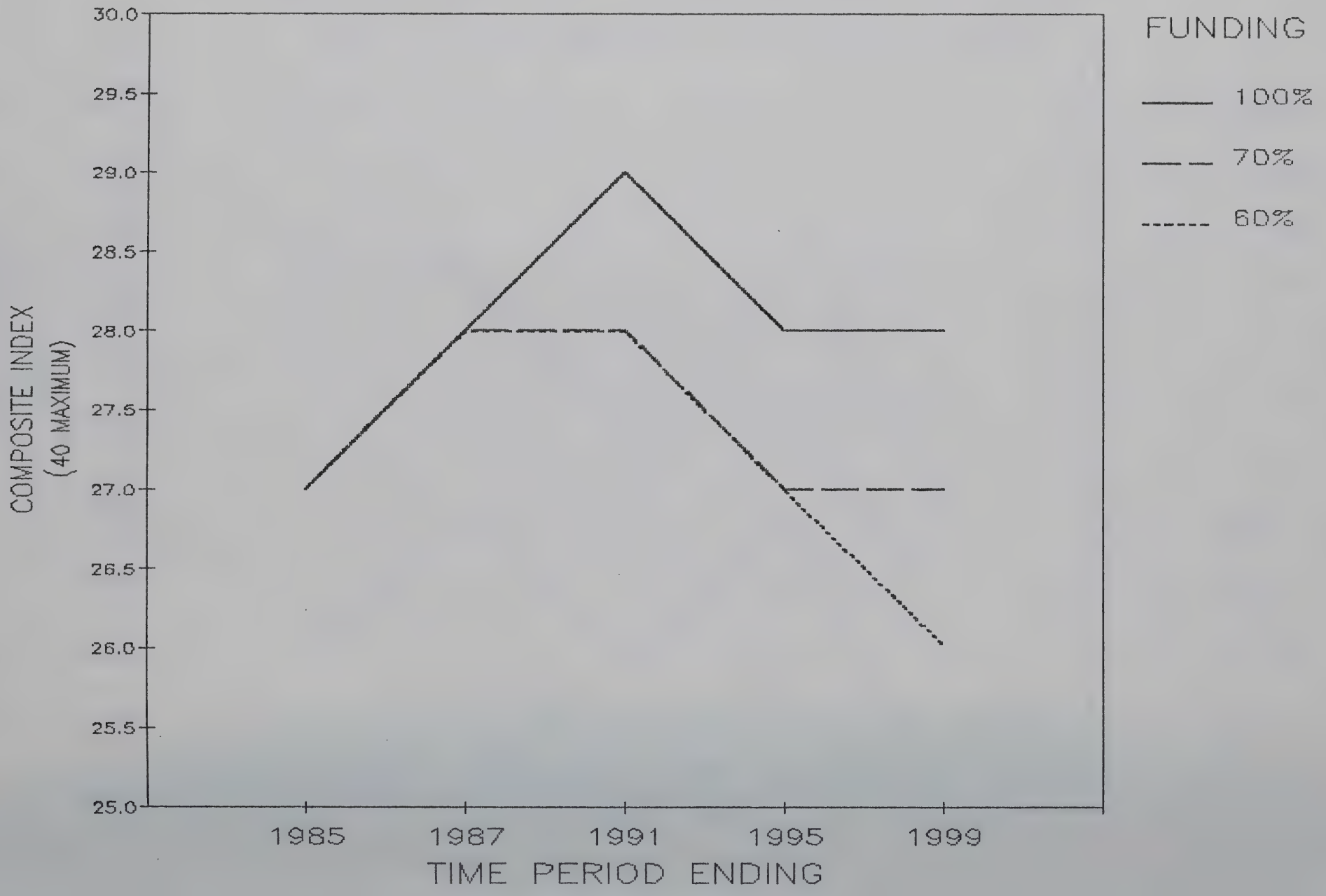


Figure 27

EFFECTS OF FUNDING LEVEL ON CAPACITY INDEX



APPENDIX E

LOCAL SUPPORT FOR HIGH GROWTH AREAS

High Growth Corridors	1985-87	1988-91	1992-95	1996-99
Route 1	--	40	100	110
Route 1 North	--	11	27	29
Route 9 (Monmouth, Ocean)	--	22	56	62
Route 17	--	3	8	8
Route 34	--	7	19	20
Routes 38,70,73	--	36	89	98
Routes 46/3	--	10	25	27
Route 78	--	26	66	73
Routes 80/10	--	22	54	60
Route 206	--	12	30	33
Route 280	--	2	6	7
Route 287	--	12	29	32
Route 130	--	16	41	45
Atlantic City (40/322, 30, 9)	--	32	80	88
East-West Freeway	--	48	120	132
Hudson River Waterfront	--	9	22	24
Meadowlands	--	13	32	36

APPENDIX F

FY 86 FEDERAL FUNDING
(In Millions of Dollars)

	Federal	State Match
Interstate	$129.0	14.3
Interstate - 4R	35.8	4.0
Consolidated Primary	56.6	18.9
Urban Systems - Non-Attributable	1.8	.6
Urban Systems - Attributable	28.0	9.3
Rural Secondary	5.5	1.8
HPR	5.4	1.0
Planning	2.3	.4
Bridge Replacement	97.0	24.3
Rail/Highway Hazard Elimination	3.2	.4
Hazard Elimination	5.0	.6
Interstate Transfer	37.4	6.6

APPENDIX G

NJ TRANSIT CAPITAL PROGRAM OPTIONS

PROJECT	COST	1987	1988	1989	1990	1991	1992
Rail							
Facilities	373.1	72.8	67.7	66.5	66.4	58.8	41.0
Rolling Stock	250.8	80.6	50.3	33.3	22.3	22.8	41.5
Bus							
Facilities	156.3	68.9	26.3	19.0	13.6	13.9	14.6
Rolling Stock	331.7	68.9	69.2	73.3	0	57.7	62.6
ADDITIONAL BASE PROJECT							
Atlantic City Railroad	105[1]	35					
Bus/Rail Park-Ride	60	10	10	10	10	10	10
TOTAL BASE PROGRAM	1276.9	336.3	223.4	202.1	112.3	163.2	169.7

CAPACITY PROGRAM

PROJECT	COST	1987	1988	1989	1990	1991	1992
Montclair/Boonton	40		10	10	20		
West Shore Railroad	200		20	45	45	45	45
Busways	200		40	40	40	40	40
Monmouth/Ocean	100		10	30	30	30	
PSNY Access[2]	50-465	10-25	30-70	10-110	0-110	0-110	0-40
TOTAL CAPACITY PROGRAM	590-1005	10-25	110-150	135-235	135-245	115-225	85-125

NEW INITIATIVES

PROJECT	COST	1987	1988	1989	1990	1991	1992
Reverse Kearney	10		10				
Newark Airport	200		20	60	60	60	
Hoboken Ferry	140		70	70			
Waterfront	200	25	50	75	100	125	125
Stadium Access	100			10	40	50	
TOTAL NEW INITIATIVES	950	25	150	215	200	235	125

TOTAL BASE + CAPACITY + NEW INITIATIVES

2580-2995	371-386	499-539	522-622	386-496	443-553	359-399

1 $35 million to be spent in FY '86

2 Costs for PSNY (Penn Station) Access are dependent on the amount of added peak period capacity that can be created at the terminal and on the Northeast Corridor which feeds. The low end of the range represents no new capacity at Penn Station, combined with the least-expensive options for using the excess capacity now available. The high end of the range represents the cost of significant work to increase train capacity at Penn Station --up to 30 trains per hour -- and the highest cost combination of options likely to be implemented to use the added capacity.

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